AUSTRALIA'S DYNAMIC ELECTRONICS MONTHLY!

Electronics Today INTERNATIONAL

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MARCH 1986

TEACHING THE ELECTRONIC BRAIN: Microprocessor Development

GUIDE TO CIRCUIT FAULT FINDING

PROJECTS:

MIDI MUSIC INTERFACE

FORTH CONTROLLER

INTELLIGENT MODEM POWER SUPPLY

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Electronics Today INTERNATIONAL

MARCH 1986

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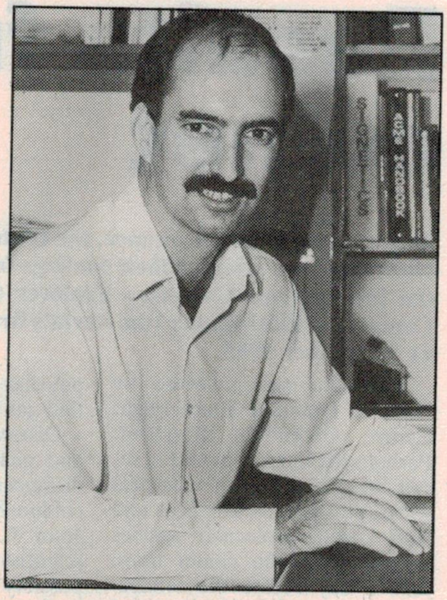


IT COMES AS A SURPRISE to many Australians that the respected United Nations bodies, the World Bank and the International Monetary Fund, do not regard Australia as even a member of the first world, the world's developed countries.

Obviously we are not regarded as one of the underdeveloped countries described as the third world, but somewhere in the middle in a not so large group called developing. We are not regarded as developed because we have not been able to support a manufacturing industry with much of its sales in the export market.

As well, a very large part of Australia's commercial activities are in primary industry and very rudimentary manufacturing. While I certainly would not down play the importance of these more basic industries to the country's welfare, they are regarded in some circles as a sign of a 'not so advanced' nation.

As I said, all this will come as a great surprise to many, but for some it is not surprising at all. So it is that technology has become the flavour of the month, or year, or decade, in Australia.

Though rarely described in so ruthless a fashion there have been many valiant efforts to raise Australia's awareness and actions.

Some of the best efforts have come from schools, which, with virtually no resources, have embraced what part of technology they can. The result will be not just a lot of computer programmers but many accountants, doctors, market researchers, builders and plumbers who are comfortable using computers as work tools.

An admirable effort indeed, but just when many people in schools might be about to congratulate themselves, I would like to say they simply scraped the top of the technology iceberg. There are many areas of technology, some more general than others. Computers is a very generally applied area, slightly more specific and much harder to come to grips with is electronics hardware.

Electronics pervades many areas of the manufacturing industry in both products and the processes used to make products. In the future it will be a vital element in most successful manufacturing businesses.

We don't just need electronics engineers and technicians but a whole range of people in other disciplines who are comfortable in their understanding of the limitations and capabilities of electronics.

As a magazine we can play a small part. Our "1986 High Schools Electronics Competition" will hopefully raise the general level of interest in electronics among those who in not too many years will control Australian industry.

David Kelly
Editor

NEXT MONTH

CAR AUDIO

ETI goes for a drive to check out what's been happening in car audio. The two new things on the scene are CD players and AM stereo. We look at their influence, offer a few tips on installing systems, mounting speakers and have words on some other exotic accoutrements.

MICRO-MINIATURE FM BUG

When Siemens challenged us to build the 751 miniature FM transmitter with surface mounting components, we jumped. In the end, it was Philips that came through with the parts and the know-how (with an article on surface mounting) and with this help we made a few innovations; this time we're building a surface mount receiver as well, and changing the frequency to 27 megs.

LAS VEGAS CES

The Winter CES in Las Vegas is very, very big. All the new gear for 1986 is polished up and displayed, visitors are dazzled. But it doesn't faze Louis Challis who marched up and down the rows and rows of CDs, videos, TVs, hi-fi and took in a few other things as well.

REVIEWS

Under scrutiny next month are the Yamaha YCD1000 car CD player, the Sony XR-A740 AM stereo receiver, the Amstrad CPC6128 PC and (not forgetting basic engineering skills) the Scope soldering workstation.

Results from comet

The comet under most attention now: Comet Halley. The ICE expedition confirmed the 'dirty snowball' theory of comet composition.

Scientists from the US, France, the United Kingdom and West Germany have released their findings from the rendezvous of the International Cometary Explorer (ICE) spacecraft with Comet Giacobini-Zinner (the world's first such rendezvous) on 11 September 1985.

The data was collected by NASA's Goddard Space Flight Centre, Greenbelt, Maryland. Perhaps the most unexpected result was detection of electrical wave (plasma) disturbances and high speed, molecular species coming from the comet more than a day before the rendezvous. Detection of the electrical waves was made while ICE was 1,429,200 miles away from the comet. Scientists had theorised that first detection might occur just a few hours before the spacecraft crossed the comet's tail.

A few hours after initial detection, but still one day prior to the intercept, two of the ICE's instruments discovered electrically-charged particles (ions) as far as 1,130,000 miles from Giacobini-Zinner.

According to Dr Robert Hynds, of Imperial College, London, who directed the energetic proton experiment, it is believed that the gas molecules escaping from the comet's nucleus were ionised by solar ultraviolet light and then picked up and accelerated back toward the comet by the solar wind, a constant outpouring of magnetised, electrified gas from the sun.

Discovery of the plasma waves and 'pick-up' of the ions at great distances from Comet Giacobino-Zinner prompted Dr John C. Brandt, ICE comet scientist at Goddard, to predict a possibly larger role for the spacecraft than earlier planned. Brandt reasoned that, "the results from the ICE encounter leads to the conclusion that ICE may directly detect Halley". The results also indicate that Halley measurements by other spacecraft should be initiated earlier than previously planned.

It had been expected earlier that ICE, while between Comet Halley and the sun in late March and early April 1986, would gather data only on variations in the solar wind to compare with the resulting disturbances caused in the comet's tail as photographed by ground telescopes.

In another finding, Dr Samuel J Bame, of the Los Alamos National Laboratory, reported that in contrast to the hot electrons on the outskirts of the comet, its tail consisted of a dense, narrow structure of cool plasma. This finding was also made by the radio wave experiment of the Meudon Observatory in France.

The ICE's ion composition experiment, directed by Dr Keith Ogilvie of Goddard, made the first direct measurements of molecules in a comet. The experiment found mainly water vapour ions (H_2O+), confirming the 'dirty snowball' model of comets.

A major prediction confirmed by the ICE data was that the magnetic structure of the comet's plasma tail consisted of two parallel lobes, each threaded by a magnetic field of opposite polarity. This structure, predicted by Nobel physicist Dr Hannes Alfven in 1957, was mapped by ICE's magnetometer experiment.

Putting conflicting scientific conjecture to rest, the ICE mission revealed that no clear-cut bow shock — a surface moving ahead of the comet like that through which a jet aircraft passes as it breaks the sound barrier — accompanied the comet. Instead, experimenters found a transition region around the head of the comet, in which the solar wind has been heated, compressed and slowed.

Neither the ICE spacecraft nor its instrument payload suffered any detectable damage as a result of the impact with the comet's dust. In the historic intercept mission, ICE sliced through the 14,000 mile wide tail of the comet, 4800 miles behind the cometary nucleus. Travelling at 46,000 miles an hour, ICE emerged from the tail approximately 20 minutes later.

The encounter was a high point of a seven year odyssey through space for ICE, launched in 1978 as the International Sun-Earth Explorer. The spacecraft was diverted to fulfil its comet rendezvous at the suggestion of Goddard engineer Dr Robert Farquhar. Farquhar, after thousands of computer simulations, engineered the ICE past the moon five times in 1983, using lunar gravitational help to give the spacecraft the additional thrust necessary for the intercept.

Doh re me VDU

Bridging the chasm between the creative inspiration that produces a new piece of music and the laborious job of translating it into the thousands of crotchets and quavers of musical notation is a new pitch recognition system that writes each note as it is played, stores what it 'hears' and will play it back on command.

Developed at Cardiff University Industry Centre the system combines a microphone, signal processor and versatile graphics software. The first two programs are designed for the descant recorder. One is essentially an introduction to the instrument and lets very small children choose a cartoon character which jumps into position on the musical staff as they play each note. Simultaneously a simple diagram appears on the screen showing which holes to cover to produce the notes that make up the chosen tune. As the child's technique improves the prompt diagram cuts out, only reappearing when the same mistake is repeated.

More sophisticated is the tutorial program which takes the player from basic instruction on how to produce each note through to instant notation and playback of the composition. The finished piece can then be printed using a standard word processor printer.

The pitch processor also has obvious applications outside music such as a security device for industry — allowing access only on a recognized specific sequence of notes — or even geared to monitor the performance of machinery by signalling changes in the pitch of electrical motors.

BRIEFS

Australian cable in Telecom's fibre optics link

The first section of Telecom Australia's new optical fibre cable network is now being ploughed-in at Gundaroo, 50 kms north of Canberra. The cable used in this initial link in the Sydney-Melbourne telecommunication trunk route is being manufactured by Austral Standard Cables Pty Ltd at its Clayton, Victoria, plant.

Mel Ward to lead Telecom Australia

Telecom Australia's chief general manager, Mel Ward, has been appointed managing director of the organisation following the resignation of W.J.B. Pollock AM, to take effect in April.

Fault diagnosis system uses laser probing

National Panasonic's parent company, Matsushita Electric Industrial Co of Japan, has announced that its semiconductor research centre has developed a laser probing technique for VLSI fault diagnosis. The system improves the fault diagnosis processes of VLSIs assembled in sub-micron rule, resulting in an efficient design evaluation and enhanced reliability.

Rural telecommunications system for OS markets

Telecom and NEC Australia have signed an historic agreement for a joint enterprise to sell the Australian Digital Radio Concentrator System (DRCS) on the international market. The solar-powered DRCS system was conceived by Telecom's research engineers and is manufactured in Australia by NEC at its Mulgrave plant.

Funding for IC fabricating machine

The Enhanced Discharge Silicon Wafer Dry Etching Project will receive government funding of $370,000 over 10 months under the Australian Industrial Research and Development Incentives act. The project will be carried out by Unisearch Pty Ltd on behalf of the University of New South Wales where the enhanced discharge concept has been developed by Dr Chris Horwitz, in the university's electrical engineering department laboratories.

New era in external uni education

Deakin University in Victoria is participating in an educational revolution that in the next 12 months will see the establishment of a telecommunications network linking tertiary institutions with students throughout the country.

Electronics 86 show

Electronics 86, the fifth Australian international electronics and computer technology exhibition and conference, will be held from 7-9 October 1986 at the Royal Showground, Adelaide. The show is sponsored by the Electronics Association of South Australia (EASA) and this year will be organised by Australian Exhibition Services (AES) Pty Ltd. For further information contact AES on (03) 267-4500.

Mazda's delivery van of tomorrow

Mazda Motor Corporation has unveiled a prototype of tomorrow's delivery van, the Mazda Telecom Delivery, which is intended to function as 'an office on wheels'. Combining innovative vehicle design with the latest telecommunications and computer technologies, it is equipped with a full-function computer terminal connected with the main head office computer.

NASA suspects possible ancient civilisation

Using remote sensing technology, NASA's National Space Technology Laboratories (NSTL), and the University of Colorado at Boulder, have uncovered information that suggests a civilisation existed in the subtropical Peruvian jungles prior to the Incas.

Tom Sever, NASA's principal investigator, and Tom Lennon, archaeologist and co-director of the university's Rio Abiseo National Park Project, jointly completed a five-day expedition into the jungles of Peru's Rio Abiseo National Park after remote sensing, by satellite and aircraft, permitted the explorers to map and select the field investigation sites.

Prior to the field exploration, Cerro Central, the largest site including more than 250 buildings, was discovered by the remote sensing operation. The ancient site of Gran Pajaten, which included only 30 buildings, previously had been the major point of interest. Sever said, "We know now that Pajaten is probably the smallest and least important of the sites. We are fairly confident that we have approached the very edges of a new civilisation and we believe that the farther in we go, the higher and more complicated the elevation of architecture and civilisation will be".

Sever said some plant and animal species, thought to be extinct, were discovered. "That is the reason the expertise of more than 30 support people and interdisciplinary scientists was required on the expedition.

A materials dating process is currently under way to determine when the civilisation existed. Sever continued, "Our guess right now is that the civilisation was pre-Inca because the architecture is circular and statuary have very delicate motifs, in comparison with the Inca ruins which are long, narrow structures with corner bases. This civilisation built in a totally different and perhaps more advanced achitectural style than has been seen in the Inca civilisations".

NSTL was asked to collaborate in the investigation with the University's Anthropology Department because of the installation's expertise in satellite remote sensing and image analysis.

According to Sever, NSTL remote sensing specialist and archaeologist, the investigation represents the best example of remote sensing application and perhaps the only known means by which the objectives of this project could be obtained. "The job certainly could not be accomplished on foot or by ground survey. We are dependent upon remote sensing because the jungle-cloud-forest environment is treacherous and extensive. Thus, we needed to select where to send the field investigators."

CRO winners

Congratulations to the winners of our ETI-Dick Smith Electronics CRO Competition (ETI, Nov 85). They were Wen Liang Soong of Fullarton, SA, and B.G. Sloss of Canterbury, Vic, whose entries were the first correct ones opened.

Both winners were recently presented with their prizes — lightweight 6.5 MHz CROs from DSE, which bring the facility of a laboratory oscilloscope to the home workbench.

Condolences to the hundreds of entrants who weren't successful, but keep watching ETI for more great competitions. Better luck next time!

IBM Australia at World Expo 88

IBM Australia has announced plans for a major technical pavilion at World Expo 88.

Its plans for a display, covering 1000 square metres on the Expo site, represent the largest corporate pavilion commitment to date.

The announcement of IBM Australia's participation in Expo 88 was made at a luncheon hosted by the Queensland Premier, Sir Joh Bjelke-Petersen, at Parliament House.

Sir Joh welcomed IBM Australia's decision to participate in the Expo. He said the decision underlined corporate recognition of the value of World Expo 88. He said it was another sign that Expo would be a major success.

The Expo Authority's chairman, Sir Llewellyn Edwards, said discussions were continuing between the Expo Authority and IBM Australia in relation to the Expo's computer and word processing requirements.

Managing Director of IBM Australia, Mr Brian Finn, said the total investment by IBM Australia would be more than $3 million, but this could increase during the run-up to Expo.

"Although the contents of the IBM display have not yet been finalised, it will reflect IBM's position as a leader in the technology industry," Mr Finn said.

"Expo 88 is a major bicentennial project and the first Expo to be held in Australia this century. Obviously, it is an important and historic event and, as a leader in the information technology industry, IBM is pleased that it can make such a positive contribution."

More than 30 countries and 20 corporations are expected to exhibit under the Expo's theme 'Leisure in the Age of Technology'.

The corporate commitment to World Expo 88 is now worth more than $23 million.

COMPANY NEWS

The Canadian video terminal manufacturer, Volker-Craig Ltd, is now represented in Australia by Databridge Electronic Communications of 604 North Rd, Ormond, Vic 3204. (03)578-0814.

Parameters of Sydney has moved to larger, modern premises. The new address is Centrecourt, 25-27 Paul St Nth, North Ryde, NSW 2113. (02)888-8777.

International standards to help high-tech

Many Australian businesses, particularly manufacturers of high-technology products, will benefit from recent agreements between this country and both the UK and USA.

Science minister Barry Jones, announced that the CSIRO National Measurement Laboratory has exchanged statements with the corresponding UK and USA laboratories to recognise the equivalence of six of the most basic primary standards of measurement: length, time, temperature, voltage, capacitance and resistance.

"This mutual recognition of equivalence should assist many Australian businesses, particularly manufacturers of high-technology products who are required to satisfy stringent technical specifications set by UK or US partners," Mr Jones said. The minister added that in the past it had sometimes been difficult to convince foreign companies that Australian based measurements would fully satisfy their requirements.

The new statements recognise an extremely high degree of equivalence between the national standards. For example, the standards of electric resistance are equivalent to within two parts in one million, the standards of length to within two parts in one thousand million, and the standards of time and frequency to within two parts in ten million million.

The first of the agreements was reached in London on 28 October last year when Dr W. R. Blevin, CSIRO's chief standards scientist, signed and exchanged statements of recognition with the director of the UK National Physical Laboratory, Dr P. Dean. The second agreement was signed three days later when Dr Blevin exchanged similar documents with the director of the National Bureau of Standards, Dr E. Ambler in Washington.

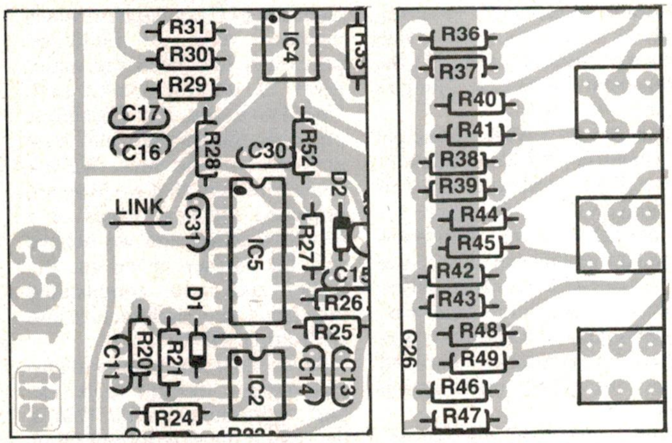
Copies of the statements of equivalence are available from **Dr Paul Hewitt, CSIRO Division of Applied Physics, National Measurement Laboratory, PO Box 218, Lindfield, NSW 2070.**

NOTES & ERRATA

Project 169, Low distortion audio oscillator Pt 2, November '85: Resistors, R38-R49, are labelled incorrectly on the overlay. The right ordering is reprinted herewith. Also on the overlay, the pc board track from pin 2 IC3 was shown leading to pin 16 IC5. Rather it should lead to pin 15 IC5. To correct this, cut the track from pin 2 IC3 at pin 16 IC5, and attach fly wire between the cut track and pin 15 of IC5. The correct layout is also reproduced.

Project 689, Bus sharing for the Commodore, January '86: Diode D3, on the overlay should read ZD1 as per the parts list.

Project 142, dc Power Supply, February 1979: The circuit and wiring diagrams for this project contain a mistake that all builders should be aware of — even at this late stage. Wires from the transformer T1 (PF4244 240V/32V 300 VA) are incorrectly labelled orange and white on the circuit. They should be transposed so that 'orange' should connect to the rectifier rather than 'white' as is shown, and 'white' should connect to the circuit board instead of 'orange'.



Letters to the Editor

The great audio swindle

I WISH TO take issue with some of the claims made by the proponents of CD players.

The maximum peak sound level encountered in a live performance is approximately 120 dB SPL for a symphony orchestra, and can easily go higher in amplified music concerts. In a quiet hall, the background noise level is often lower than 20 dB SPL, when weighted correctly to account for the ear's frequency response at this volume. This amounts to a dynamic range of over 90 dB for live music.

Unfortunately, the two most popular forms of storing recorded music today, records and cassette tapes, have dynamic ranges much less than the 90 dB of live music. Conventional records generally have 45 to 50 dB dynamic range, while the more carefully prepared audiophile pressings have slightly over 60 dB dynamic range. Even the best metal tape cassettes do not reach 60 dB without a noise reduction system.

In order to fit into this range an audio signal is subjected to compression and/or gain riding, wherein the loud passages are reduced in level, and the soft passages are increased in level, thereby reducing the overall dynamic range.

The new form of storing recorded music is the compact disc for which the manufacturers are claiming 100 dB dynamic range. This can be achieved, but is a great misrepresentation in that 80% of the discs released to date are from analogue masters and only 55 dB dynamic range is attainable, all things being correct.

Another misrepresentation of the compact disc is that it cannot be scratched or affected by dirt. This is incorrect. Once a disc has been scratched it will not be played by most players. Dirt on the disc will cause problems with the sound reproduction mainly in a surging effect.

The proponents of the CD player will point out the ease of operation, length of playing time and, of course, no surface noise.

On the other hand the proponents of the analogue system will advise that the disc lacks presence (ambience) appears to have lost harmonics and when comparing the disc to the record one finds that depth of sound is missing on the compact disc.

It would seem that the arguments for and against compact discs are going to go on for some time. But it is to the point to note that even with digital recording techniques there is still no substitute for the microphone.

With the Japanese marketing machine in top gear promoting the virtues of compact disc (whether they are actual or not) we have got the system here to stay. However, in my opinion a full orchestral piece reproduced from a record on a good turntable arm and pickup cartridge is more sonically correct and less harsh to listen to than the comparable piece reproduced on compact disc.

Gary Fitzsimmons,
Consumer Electronics Suppliers Association

Wherefore the artwork?

DURING THE LAST several months I have noticed a disturbing trend by your magazine not to publish printed circuit board details. As a hobbyist reader, this represents nothing more than an effort by your organisation to extract more money from the readers of your publication, just one more 'nail in the coffin' and as such it will now put it out of my reach to even contemplate using your magazine as a source for projects.

Also, as I live some one hour's drive from the nearest kit stockist this adds further to the cost of the kit, not to mention time, involved in travelling to and from the city. As these kits are available off the shelf, I have no further use for your publication as a source of information for projects; all I have to do is look up the kits in a list from the supplier and use his construction details and information to verify if the kit is what I require.

Trevor Bartlett
Nuriootpa, SA

Ouch! There is no conspiracy! It is our furthest intention to be squeezing money out of our readers, and we apologise profusely. Since we became aware of our oversight we have taken care to ensure space is left to include the artwork.

— Ed.

Talking to Microbee

REF MR BIRD'S letter to the editor (ETI Nov '85).

I took my sick 'Bee' to the West Australian branch of Applied Technology (Microbee Systems), explained how it was used by myself for library business and requested return in a reasonable time. After a week a few discreet calls were made. I finally ascertained that service on my unit had not even commenced; Microbee assured me it would "get around to it soon". I indicated that I would collect the unit and have it serviced elsewhere.

When collecting the unit, I ventured a mild complaint about the time taken and lack of repairs. The person in charge dared me to write to the manager.

The letter I despatched on 17 September was a modest statement of the event, ie, lack of service and abuse of a customer.

The manager obviously does not answer any complaints, this seems a very sensible way to avoid work and discourage Microbee users.

R. Wallace
Perth, WA

Microbee talks back

THANKS FOR THE opportunity to comment on Mr Wallace's letter. To be honest I was surprised by Mr Wallace's allegations as our people staffing the Perth centre are particularly enthusiastic and customer orientated. In fairness to them, I immediately contacted our Perth Manager, Mr David Crossley, and asked for his comments.

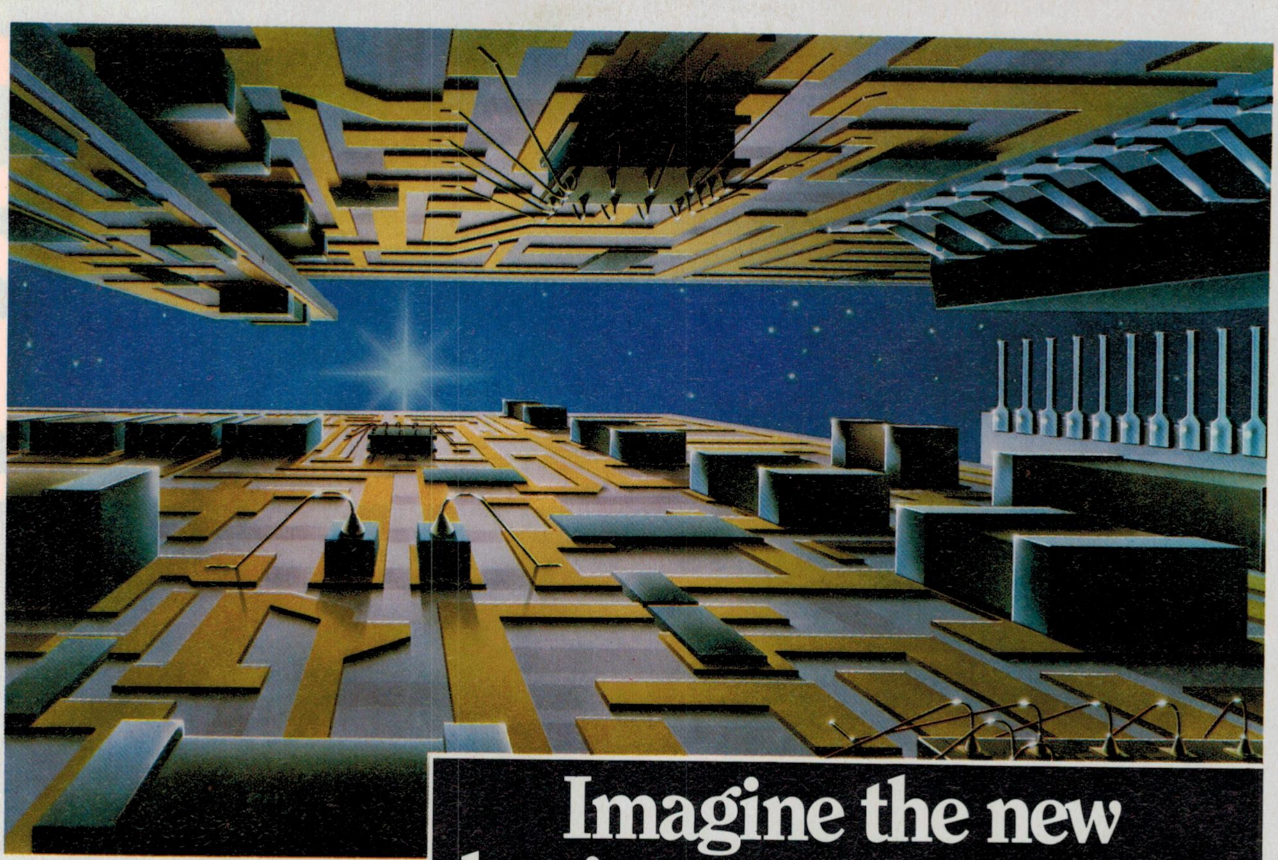
It appears that Mr Wallace left his computer with our service department, but returned in only three or four days expecting repairs to have been completed. At the time, the service department was very busy (we have a great many machines installed in WA schools), and had not been able to attend to Mr Wallace's machine.

To me this does not sound unreasonable; we are a small company, and the economies of manufacturing computers in Australia mean that we cannot afford sufficient service people to completely obviate all temporary overloads and delays. In fact I believe most reasonable people would agree that delays of even three or four weeks are not unusual for repairs to equipment like video cassette recorders, even by much larger firms than ourselves. Normally MSL endeavours to achieve a service turnaround of less than two weeks, and frequently much less.

Apparently Mr Wallace took the advice to write to our Managing Director, and as I write this our MD, Mr Owen Hill, is currently looking into the matter personally during a trip to Perth.

Needless to say, if we are able to improve our level of service and customer support in Perth (or any other area, for that matter), we will certainly do so.

Jim Rowe
Communications Manager
Microbee Systems Limited
North Ryde, NSW



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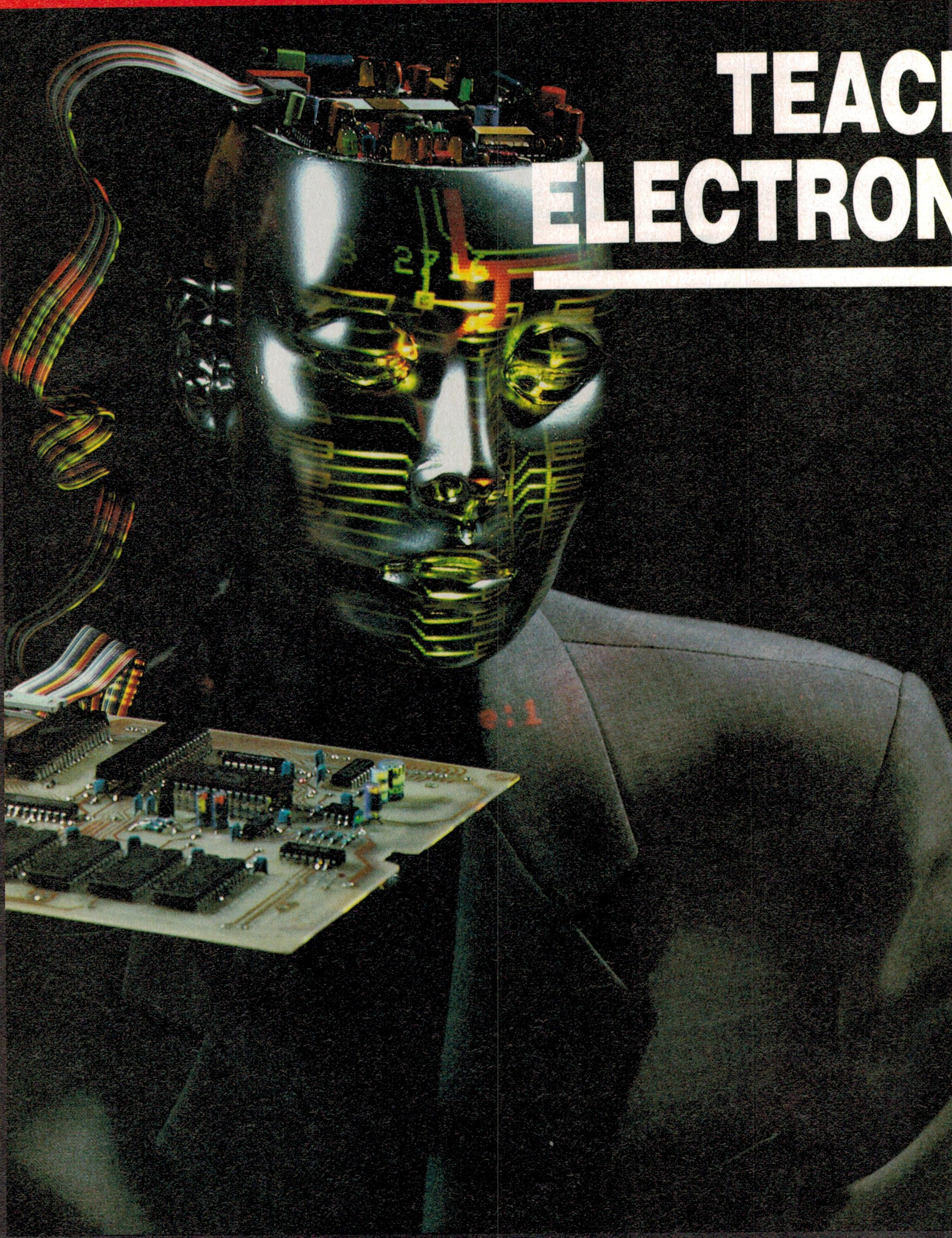


...ING THE ...C BRAIN

Software development can mean a whole lot of problems, any help is welcome. Such help is usually from microprocessor development systems which can come as a powerful total package, but frighteningly expensive, or both modest in assistance and cost.

Jon Fairall

TURNING AN IDEA into electronic hardware is fairly straightforward, at least conceptually, as long as you stick to hardware. You have an idea, draw up a schematic, put the bits together, and then get out the test instruments and ensure that everything happens when it's supposed to. If, as all too often happens, it doesn't work out quite that simply, in theory it's still not a very difficult job to find out why by making the appropriate electronic measurements.

With the development of microprocessors, machines with brains and software dependence, all this changed. It's impossible to see the mental activity of the machine, thus impossible to correct it if it's not doing what it's told. There are no electronic measurements to be made. Even when the faults do have hardware manifestations, problems remain. Because processors move so fast on an irregular basis, it's almost impossible to use conventional test instruments like oscilloscopes and multimeters to find faults.

So the requirement is a machine that allows a design engineer to develop microprocessor-based products with as much ease as his colleague develops analogue circuits. Such devices are called microprocessor development systems, and come in a huge variety of performances and prices.

History

In the beginning the way one developed microprocessor projects was with a pencil,

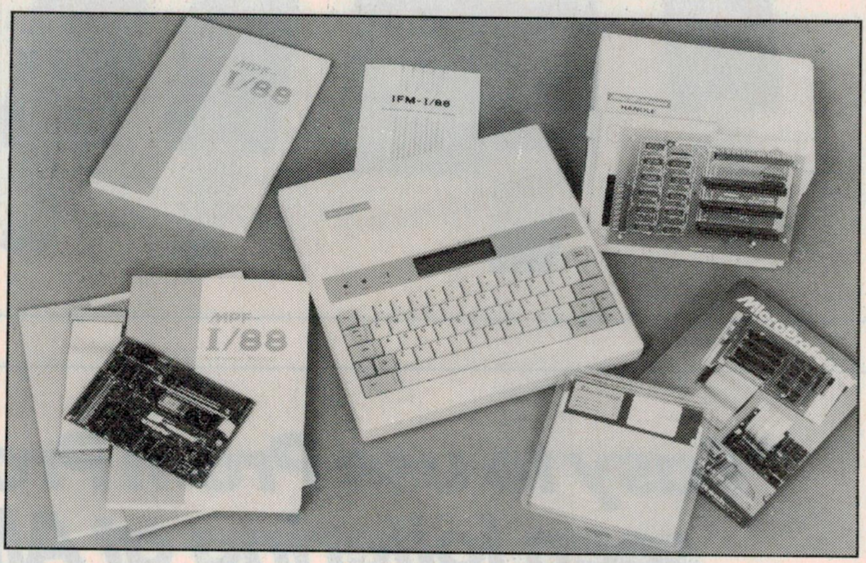
MICROPROFESSOR MPF-1/88

The MPF-I/88 from Multitech is typical of a low end development system. It is designed primarily as an educational tool for teaching machine language programming of the 8088 microprocessor. However, with expansion modules it can be turned into quite a powerful little development system. Naturally, it doesn't compete with devices like the Philips PEDS. On the other hand its cost isn't in the same league either.

However, it does share some features with more expensive machines. For instance, the MPF-I/88 is user expandable up to the level required by the user. The basic unit is all that is needed for instruction in machine code. It contains a keyboard, two line LCD display, the 8088 processor plus associated RAM (24K) and the monitor programme in ROM. There is also an editor assembler on board to allow the composition of programmes, debugging and running on the internal processor. Nonvolatile memory is provided by a cassette interface.

There are a number of expansion modules available. A printer can be connected via a Centronics interface. A special interface module provides a number of slots into which 'option' cards can be inserted. One of these cards allows connection to the slots of an IBM-PC. Indeed the slots on the card are IBM-compatible, so you could use any IBM-compatible card in the system.

This introduces a whole host of powerful features to the MPF-I/88. For instance, it can work as a remote terminal, in which case you can talk to the MPF-I/88 from the PC's keyboard and read out from the screen. Mass storage can be achieved via the PC's disk drives and you can access onboard RAM (up to 512K) for program space. You plug in an asynchronous communications adaptor, monochrome or colour display adaptor and so on. And, of course, you can manufacture your own boards and write software for them using all the programming editing and debugging tools on the host system.



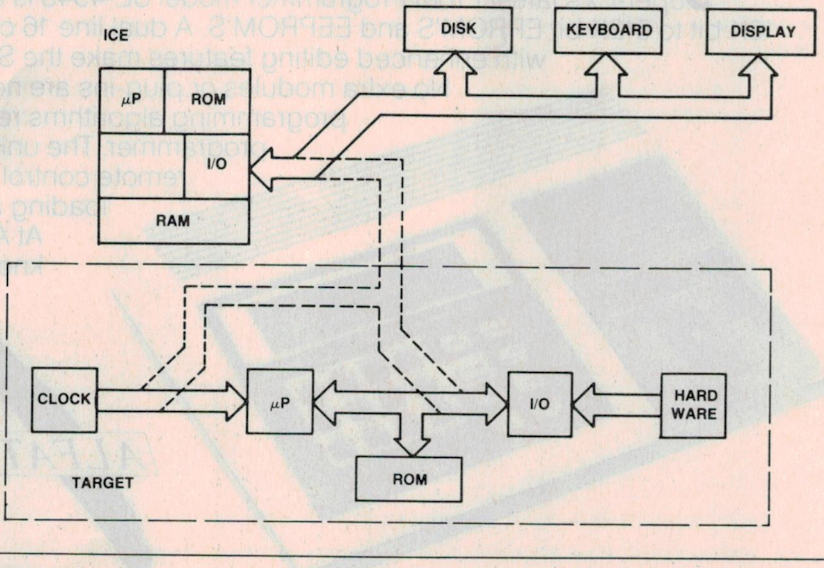


Figure 1. ICE to target system block diagram.

PHILIPS' ENGINEERING AND DEVELOPMENT

Philips 'PEDS is a typical high end development system. It's universal, with emulation of 50 different types of processor. It's fully modular, expandable both in the number of users and the number of processors being emulated. It has software to cover all aspects of product development, from design to production. It has documentation, EPROM burning and service functions, in addition to the normal software and hardware development programmes.

To get PEDS up and running you need a basic master system that includes 256K of RAM and 64K of ROM, hard and floppy disks, a 68000 CPU, two RS232 ports and a printer interface. The whole thing is glued together by a multi tasking operating system. There is also a universal debug unit and 16K of fast static emulation memory, a micro adaptor box and an assembler and emulator processor.

This can be expanded in a number of different directions. PEDS handles all the different processors via microcomputer adaptor boxes, (MABs). The user buys MABs specific to the target micro, which plug into a universal debug unit. The MAB is responsible for translating the information from the micro into a universal format that can be understood by the rest of the system.

You can also buy a state trace facility when required to assist in debugging, additional

SYSTEM

emulation memory, additional user terminals, a PROM programmer, compilers and so on.

Its cost is difficult to state, depending on the options you specify, exchange rates and so on. The minimum system wouuld set you back about $35,000. But you could easily spend $100,000 without trying too hard, especially if you needed a number of terminals.

Programming in PEDS is done via Unix. However there are also options including C, Pascal, PL/M and Fortran. Any of these is turned into machine code by the assembler. This is displayed in the mnemonics of the target micro. The assembler has sufficient intelligence to refine the code as it is assembled. For instance it can choose between different instructions in certain circumstances and will always choose the short forms of operands.

There is great flexibility in the way one develops a project using PEDS. For instance, it has a simulation mode, appropriate when no hardware is available. This means that software can be developed even before the hardware. On the other hand, PEDS has an emulation mode, in which the program is run on the target system. In addition, any mixture of these two extremes is possible, so that one can run software on the half a target system that exists, while the other half is still being simulated by the PEDS.

paper, PROM burner and an awful lot of patience. One wrote out the program, burnt it into the EPROM, put the EPROM back into the board and hoped nothing blew up. If things went wrong, one went back to the paper and tried again.

Clearly, there were problems with this approach, so development systems were produced almost as soon as microprocessors themselves became commercial products in the early 1970s. Predictably, the first ones were developed by the processor manufacturers, noticeably Intel. These were essentially prototyping boards, and gave the user the freedom to enter machine code directly into the onboard RAM so that the effects of a particular sequence could be studied.

It didn't take long, however, to establish the technique of in-circuit emulation (ICE), which remains the fundamental principle behind all development systems to this day. To explain: we start with a piece of processor controlled hardware, called the target system. At a minimum it will contain the processor, its memory, input/output (I/O) stages and some other hardware to interface it to the outside world. The processor then reads its instructions from the ROM and controls the hardware via the I/O.

ICE takes over the functioning of the processor and the ROM. Usually what happens is that the ICE consists of a box with a lead coming out of it which is plugged into the processor socket on the target system (see Figure 1). The ICE itself is a computer, with its own processor, memory and I/O. The difference is that the ICE has a program already installed in it which allows it to do certain tricks.

It does all the usual house keeping you get in any computer, looking after the keyboard and screen for instance, arranging and controlling files and mass storage on disks or cassettes. In addition, it reserves a section of its own memory so that it can simulate the ROM on the target system. In other words, the I/O stage on the target system sees the ICE perform in exactly the same way as its own resident processor.

The result is that the operator can enter code directly into memory in the ICE, and then instruct the target to behave as if that code was located in its own onboard ROM. Execution of the program can be debugged by the ICE in exactly the same way as with BASIC in a domestic PC. You can step, or trace, insert break points, etc, etc, in fact use all the familiar tools of program analysis. And while all this is happening in the ICE, the target is behaving as if the particular program step has been executed in its own onboard ROM.

A refinement to this was the advent of software compilers and assemblers which allow one to write code for the processor, either in the form of mnemonic codes or in some high level language like BASIC. Actually, BASIC itself is not much favoured in this particular application. Most high level editors seem to use C or Pascal because of their inherent efficiency.

As time has passed, this basic vision of what an MDS should be has grown more sophisticated. During the late seventies and early eighties a number of leading companies like Hewlett-Packard and Tektronix began to look at design as a single process, all the way from the initial idea 'on the back of a fag packet' through to manufacture. This is only logical, as many practicing designers will attest, because of the enormous amount of time involved in documenting everything, or liaising between members of a design group and so on.

Range

And so the number and variety of systems has grown enormously. At one end of the scale, designers have piled on features and flexibility, using the increasing power of computers to do more and more and to integrate the design cycle into one discrete whole. At the other end of the scale, the same sophistication in computer design has ▶

been dedicated to squeezing the basic minimum functions into smaller and cheaper packages.

The modern high end system usually has multi-user capability, so that an entire design team can work on one machine, each user with an individual terminal. Work being created on one terminal is instantly accessible on any other so that interfacing problems between the various parts of a project are minimised. There will be text editors, and documentation subroutines, so that parts list and numbers are automatically inserted and updated as required. There is often an impressive graphics capacity to assist in conceptualising problems with flow charts and symbols.

Many modern machines have hardware emulation characteristics as well. In systems like this the structure of the hardware can be specified and the computer will then emulate its response to simulate a software program. In this way an entire project can be designed and debugged without even building a prototype.

However this hardware emulation is more fraught with danger than might at first appear. It depends for its accuracy on the extent to which the individual components are accurately modelled in the software of the emulator. Development models of this technology are full of bugs caused by unsuspected peculiarities of individual components, but it seems that most of these problems have been ironed out. Indeed, some companies are now starting to achieve notable successes in this area.

Further refinements permit the system to generate its own fault analysis for use in manufacturing and testing procedures or for quality control on an assembly line. In fact, some companies have products that allow results from the development system to be directly entered into production or management control computers.

At the same time, low end systems have also been developed that take advantage of the tremendous power of cheap modern computers. These can be either stand alone units like the highly successful Microprofessor series or plug in cards for personal computers. In the latter category the IBM-PC has become the industry standard, made all the more powerful by the large number of computer aided design (CAD) systems that have been built around it.

Of course, such systems are considerably less sophisticated than the high end machines, but still they manage to fulfil most of the fundamental requirements. There will certainly be a monitor program permitting single stepping of the program, editing and inspection of registers and memories. This type of machine sells for a few hundred dollars. For only a little more, you can get into the world of compilers and assemblers, allowing far more efficient programming.

Universal v dedicated

Another significant development in the marketplace has been the growth of universal systems. The distinction between universal and dedicated systems is that universal machines are able to handle a large number of processors, dedicated machines only one, or perhaps a single family. In some cases universal machines might be restricted in terms of the number of bits, so it might only take 8, or only 8 or 16, or some such restriction. However, the important point is that it is not restricted to the products of one manufacturer.

Dedicated devices, on the other hand, are restricted to one type or range of processor. For the most part these are made by the manufacturer of the device under question. As one can imagine, the big players in this market have names like Motorola and Intel.

The advantages of the universal machine are obvious enough: you can choose the processor that best fits the application instead of being limited to one company's product. On the other hand, makers of dedicated systems can bring some strong arguments to bear. They argue that the freedom given by the universal system is largely illusory for a start. The machine may be able to handle a dozen different micros, but can the engineer? In fact, most engineers are stuck to one, or possibly two different types.

Another advantage is that dedicated machines are far less complex than their equivalent universal machine, since emulating a single micro is a far less complex task. Low end machines all tend to be of this type for precisely that reason.

Most universal machines handle a multitude of processors with the use of separate modules, each dedicated to a single processor. This leads naturally to the idea of modular construction for the entire unit. So one of the major trends in development systems at the moment is to allow the user to determine how much, or how little, is needed to do any particular job. The Tektronix 856 family, or Philips PEDS are both systems of this type.

It's a trend that has one tremendous advantage: you only pay for what you need. It also means that the cost of developing software, although still breathtakingly high, is more and more within reach of small companies with creative ideas.

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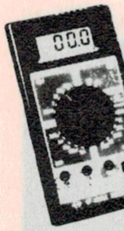

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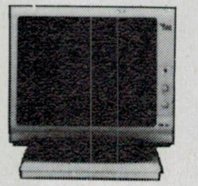

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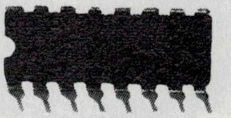

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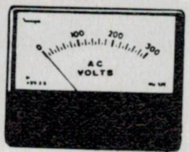

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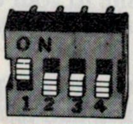

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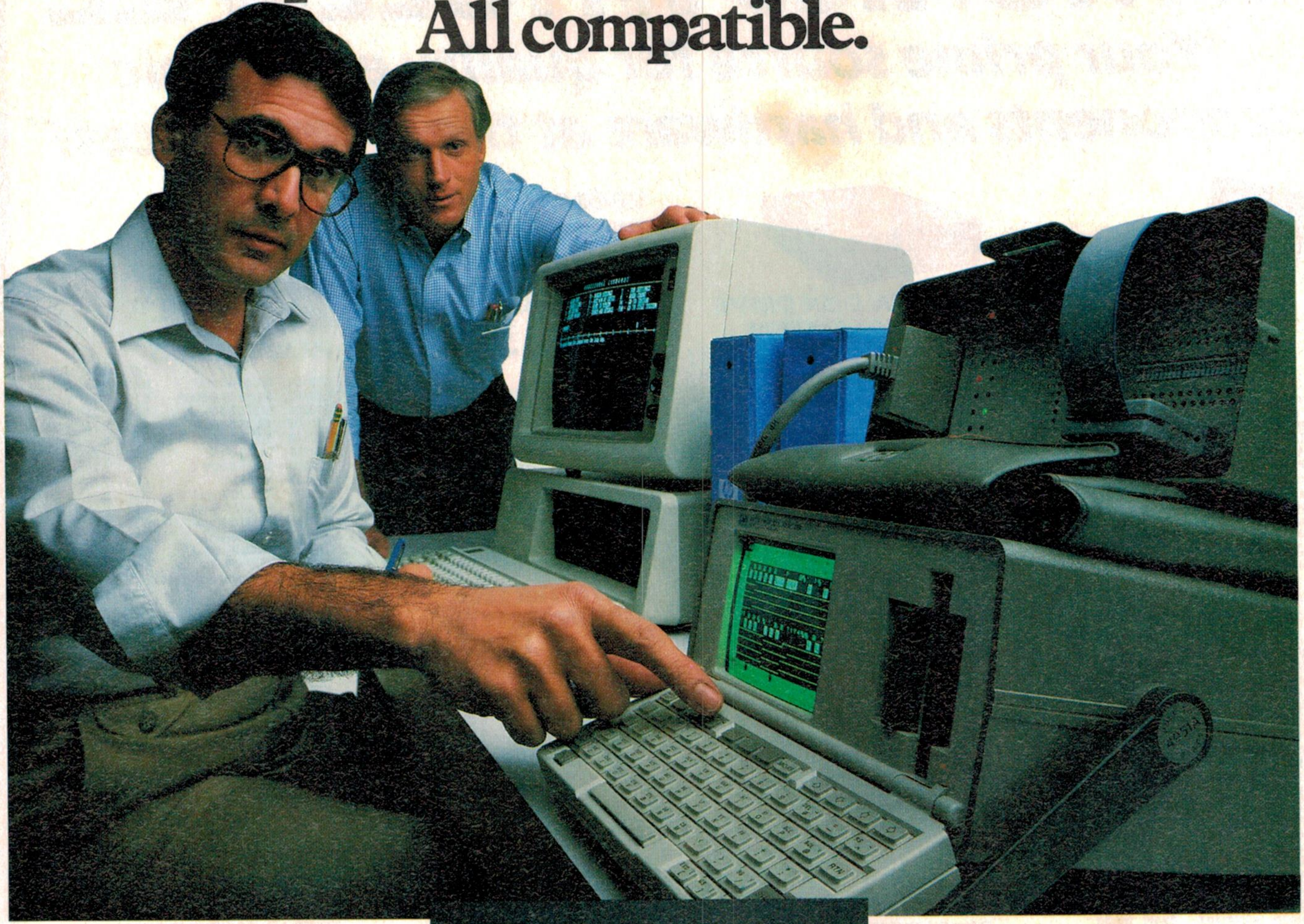

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HEWLETT PACKARD

ETI READER SERVICE 112

Loudspeaker series from Jamo

Following three years of research and development work Jamo is launching a new range of speakers with the front baffle of a concrete-like material.

In 1982 Jamo started to experiment with loudspeaker cabinets in other materials and different shapes finally concluding that concrete was an excellent material for loudspeaker cabinets. This was not from a production point of view but from a sonic view. Unfortunately concrete has many disadvantages such as extremely high cost.

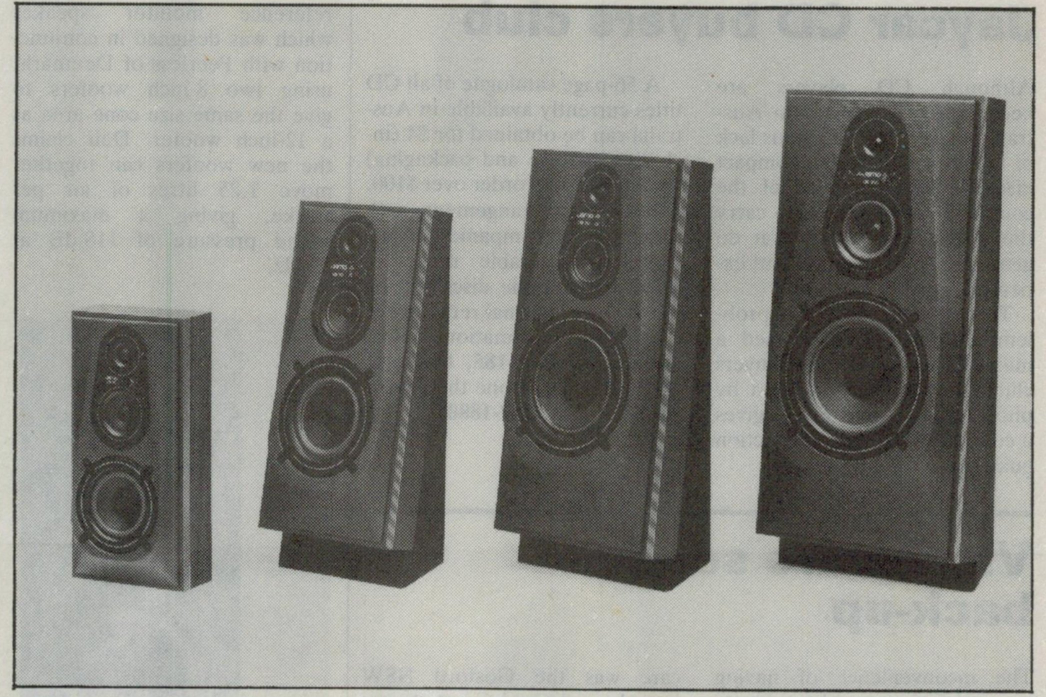
Jamo has settled on a technique of injection moulding a 1-inch thick concrete-like material between two layers of vacuum-formed polystyrene. By using vacuum formed polystyrene it was possible to give a finish and shape to the front baffle in the best possible way. As a result the loudspeaker drivers are mounted with the acoustic centre in line, thus assuring no time delay between the three drivers. The surface of the front baffle could also be incorporated with an anti-diffraction pattern, which gives the new digital monitor speakers a stereo image.

A new shaped cabinet has been developed in which none of the five sides are parallel. In this way Jamo has avoided the traditional standing waves in the cabinet and the new cabinet shape matches the front baffle. Incorporated in the cabinet is a solid loudspeaker stand which can be equipped with tip-toes or spikes.

Jamo's Centre-Bass-Reflex System has also been incorporated in the new series. The CBR-system mounts the woofer in four rubber suspension points which initially isolates the worst vibration from ther woofer before being transferred into the front baffle. The port opening, which is an air gap surrounding the woofer, gives a symmetrical loading of the woofers' diaphragm. The tuning of the bass-reflex cabinet is based on the American Schneider theories.

The speakers have electronic overload protection for the tweeter. The larger models have built-in attenuators for treble and mid-range.

The top of the range model is the CBR 200 which is a 3-way floor standing loudspeaker. The dome tweeter used in this system has a polymer diaphragm and has ferro-fluid injected in the voice coil air gap. This magnetic coil gives better damping of the tweeter and cooling of the voice coil which gives the speaker its high power handling capacity of 200 watt rms. The mid-range and woofer diaphragms are made of carbon fibre which is a light and very strong material with high internal stiffness. The 10" woofer has a specially developed dual magnet system for high efficiency and improved linearity. The prices are expected to be between $700-$2000 per pair.



JVC opts for midi-system

JVC has opted for the midi size in its range of hi-fi systems with the new MIDI-X5.

This system features a direct source selector. This computerised input selection system both selects and plays an input at the touch of a button. A 'Computer Shift Control' feature makes additional conveniences like blank search and blank skip possible by means of a special 'shift' control together with the tape controls.

The quartz locked digital synthesiser tuner (T-E30B) has presets for six FM and six AM stations, while the two-way speakers (S-E708) have passive radiators for rich lows. The graphic equaliser (SAE-E30B) has 10 frequency equaliser controls and gives the user total control.

Also included in the system are a stereo integrated amplifier (A-E40B) with 45 W DIN/channel and direct source selection; a programmable fully automatic turntable (L-E30B) with index scan and linear tracking tone arm; a double mechanism full logic cassette deck (D-W30) allowing random access of up to 10 selections, double speed tape dubbing, synchro recording, and Dolby noise reduction; plus an adjustable turntable stand (LK-E20B).

The cost of the JVC Midi-X5 system is about $2699 RRP.

Speaker connectors

A specially designed version of the AXR Series connectors, suitable for connecting a power amplifier to loudspeaker enclosures is available from STC-Cannon. The precision machined contacts ensure minimum power loss and improve performances when used in combination with high quality audio cable.

Features include rugged metal shells with satin nickel finish; positive quick action lock coupling: positive polarisation; highly conductive copper alloy machined contacts incorporating large solder bucket to accept up to 12 AWG cable (4 mm^2); enlarged cable entry capable of accepting both high quality circular audio cable to 10 mm diameter and figure eight cable with a cross section of 7 mm x 12 mm. The flat section on the connector housing can be used for circuit identification purposes. When combined with the AXR range of optional coloured boots, this facility provides multiple combinations for rapid circuit identification. They also provide convenient grub screw cable clamping.

Jaycar CD buyers club

Although CD players are becoming very popular in Australia, there is still a serious lack of readily available compact discs. Only about half of the country's record stores carry these discs, and those that do generally have a limited and expensive range.

To help overcome this problem, Jaycar has established a mail order compact disc buyers club. Discs can be ordered by phone or mail, and Jaycar gives a conditional 30-day satisfaction guarantee.

A 56-page catalogue of all CD titles currently available in Australia can be obtained for $4 (including postage and packaging) or free with any order over $100.

Jaycar has arrangements with fifteen record companies, ensuring a considerable range of titles. Cost of the discs will be less than the normal retail price.

For more information contact **Jaycar, PO Box 185, Concord, NSW 2137,** or phone the **Jaycar Hotline** on **(02)747-1888.**

Visioncare service back-up

The inconvenience of having your television or video cassette recorder breakdown can be made a lot worse by the lack of expert service to repair the set quickly, at reasonable cost, and with a guarantee of quality workmanship.

A little over a year ago Visionhire (Australia) Pty Ltd established a servicing arm called Visioncare to meet the need for servicing electronic products such as televisions, video cassette recorders, sound systems and even personal computers. One of the first to offer Visioncare was the Gosford NSW branch, and Gold Coast stores. Eventually there will be a string of Visioncare service outlets throughout Visionhire's Australia-wide network.

David Hall, Visionhire's managing director, says that the company has the expertise and resources to back up the Visioncare service, because it is an established rental specialist with some 30 branches and service centres, and also has the stability of being a multinational organisation.

Slim cabinet loudspeakers

With the new NAD 20 loudspeakers the approach has been to concentrate on aspects which contribute to sonic excellence and real performance while avoiding cosmetic 'features'.

ADS woofers were used for quick transient response and soft dome tweeters for crisp, airy, extended, peak-free highs.

The key to the performance of both drivers in the NAD 20 is a very high ratio of force to moving mass.

Special construction techniques are used so that the drivers have an exceptionally small voice coil gap. The intense field of the powerful barium ferrite magnet is focused on a voice coil of very fine wire which is double insulated and wound using special techniques.

The proprietary material used to form the cones and domes of the NAD 20 is exceptionally light yet stiff and resonant free. The cone of the woofer is progressively tapered in thickness which prevents 'cone break up' to eliminate colouration.

The cabinets are made to a slim, simple column design which occupies only 0.6 of a square foot of floor space. They are manufactured using MDS to tight tolerances, finished in a black ash with light grey snap-on grille.

New 8-inch Dali woofers

Dali has released its new Dali-8 reference monitor speaker which was designed in conjunction with Peerless of Denmark, using two 8-inch woofers to give the same size cone area as a 12-inch woofer. Dali claims the new woofers can together move 1.25 litres of air per stroke, giving a maximum sound pressure of 118 dB at 35 Hz.

The woofers work in a bass reflex enclosure, along with a 4-inch mid range, 1½-inch dome mid range and ¾-inch supertweeter.

The speakers are finished in polished walnut veneer with the woofers mounted in rubber suspensions. They sell for around $2000 per pair.

BRIEFS

Compact disc cleaner

The Discwasher Compact Disc Cleaner is a new product said to offer radial cleaning to protect against scratching the disc surface along the line of the recorded message, which can cause laser mistracking. The package includes the compact disc cleaning unit; CD-1 cleaning fluid; a cleaning pad grooming brush; and replacement cleaning pad. No power supplies or batteries are required. Detailed instructions are printed on the bottom of the compact disc cleaner. The Discwasher is available for $49.90 from Arena Distributors, 642 Albany Hwy, Victoria Park, WA 6100. (09) 361-5422.

New speaker range from Visonik

The new "David" speaker range from Visonik West Germany, was released at the International Funkausstellung Audio-Video Exhibition in Berlin last year. The new models reportedly feature improved technical performance in keeping with demand for CD compatible and high performance amplification requirements. Emphasis is on the Satellite System comprising one sub woofer and two David 6001 Mini High Performance Boxes. When placed in a room correctly, the end result is reportedly similar to the performance of a four speaker type quadro system, however using a relatively tiny amount of space. They are available from German Hi Fi, 61 Burns Bay Rd, Lane Cove, NSW 2066.

Stereo AM/FM radio-cassette from DSE

A new stereo-AM/FM-cassette deck (Cat A-6020) is available from DSE for $279. It features LED digital frequency display, a five AM/FM station memory with auto scanning and automatic noise reduction. It has a 6 watt output and separate bass and treble controls to suit personal tastes. The front-rear fader is suitable for four speaker systems.

Lloyds Bank chooses Laservision

Lloyds Bank, UK, has appointed Philips as project managers for the supply and installation of an interactive Laservision system for staff training. Lloyds requires Laservision systems to be installed in 1500 key branches and principal head office departments by the end of this year. These will provide individual self paced learning courses for Lloyds' 46,000 staff. This order for Philips in the UK follows the success in the development with the BBC of a laservision.

And HBA uses videodisc

Recently, the finance department of the Hospital Benefits Association in Melbourne leased a Pioneer Electronics L-D V1000 LaserDisc player to train its staff in the Lotus 1-2-3 computer program. It is being used in conjunction with an IBM-PC. The instant random access facility of the laser beam 'stylus' locates any of 54,000 frames of vision on one side of a single disc, and specific points can be accurately and quickly accessed in a random or pre-programmed sequence. Pioneer LaserDisc systems are making a significant impact on communications technology. Current industry figures indicate that over 100,000 industrial videodisc players are now in use in the US, Europe, Japan and Australia. Companies using videodisc systems include General Motors and IBM.

New Ross headphones

Concept Audio Pty Ltd, importers and distributors of the popular British-made Ross headphones, has released two new models. The RE-2225 comes fitted with 2 metres of cable and a 6.4 mm stereo jack plug and has the added advantage of in-line left and right channel volume controls together with a stereo/mono switch. The RE-2285 has been designed specifically for TV and video listening and comes with a 5 metre cable. It is supplied with a 6.4 mm stereo jack socket to 3.5 mm mono jack plug adaptor for mono TV and video connection. These headphones are additionally supplied with in-line left and right channel volume controls and stereo/mono switch.

Compact disc cleaner II

The new Milty Products CD cleaner comes in the form of pre-saturated single use wipes which are ready for immediate use. They are packaged in a 70 wipe drum which sells for $13.95. Further information can be obtained by calling Concept Audio on (02) 938-3700.

CD-100X CD player

A new CD player, the CD-100X from ADC is now available for $499 from Concept Audio. It features a simple and easy to use motorised disc tray; three beam laser for better tracking; programmable memory for 16 tracks; single track repeat, programmed track repeat and all track repeat; linear digital-to-analogue converter for low distortion sound; and versatile multi function display. Further information is available from Concept Audio on (02) 938-3700.

JVC video cassette range

JVC is now offering its Dynarec range of video cassettes each with special characteristics suited to specific purposes such as professional video presentation, master recordings or time-shift viewing. The different tailoring includes a high resolution magnetic coating on the HR type, head cleaning and anti-static features on the HG Hi-Fi variety, and a new magnetic coating of emulsion on the Pro. Information on these and other variations is available from JVC, 5-7 Garema Ct, Kingsgrove, NSW 2208. (02) 750-3777.

8 mm VCR CHALLENGES TOP CD PLAYERS — the Sony EV-S700ES Digital Audio Video (Video 8)

Apart from its excellent video features, Sony's new VCR can be used as a PCM audio recorder — with extraordinary results!

IN 1982 SONY and four other major manufacturers announced proposals for an 8 mm VCR format. Not long afterwards 122 different manufacturers gathered in Japan for the first 8 mm Video Conference which set up working groups. These groups quietly developed the standards which have now been ratified by the original conference members.

During my last visit to Japan at the end of 1984 I evaluated the multiple options available to the Japanese manufacturers for the new DASH format cassettes that would be used for the new DAV (digital audio video) equipment. In the ensuing period, the Japanese and European manufacturers have resolved the issues and have even submitted appropriate documentation to the International Electro-Technical Commission so that the formal standard requirements will soon be ratified.

When we reviewed the Sony CCD-V8 8 mm video camera/recorder (ETI, October 1985), I primarily evaluated the video characteristics of the system, as there was no direct means of evaluating the full potential of the audio section. I was, however, very much aware of that unit's potential as a PCM digital audio recorder. This review looks at this rather considerable potential.

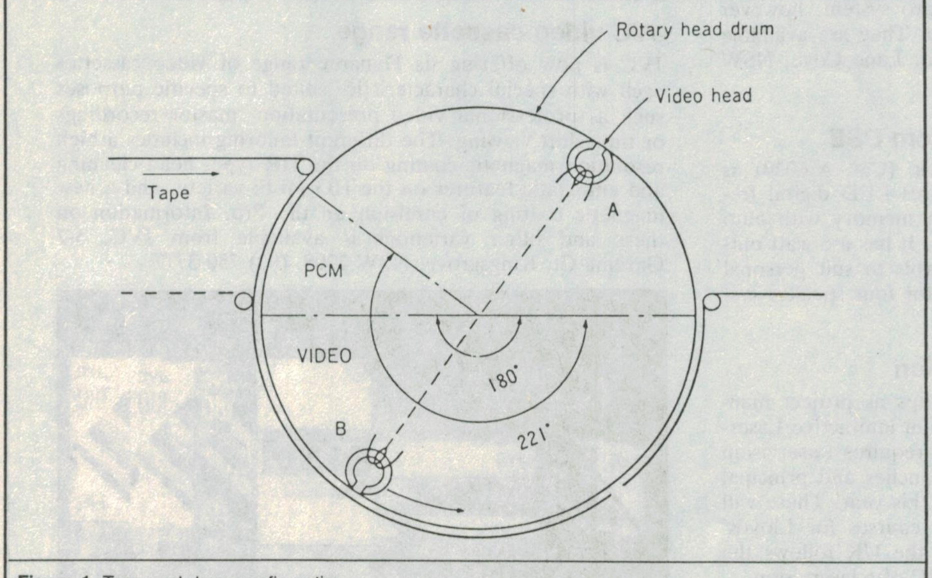


Figure 1. Tape and drum configuration.

Design features

The 8 mm video system has an energy density capacity which is 50% superior to the standard VCR cassette when used in the standard play (SP) mode and three times greater in the long play (LP) mode.

Although the Video 8 cassette is 12% larger than a standard audio compact cassette it is much more efficient because it uses a specially formulated tape with a base thickness of polyester only 9 microns thick, a backcoating 1 micron thick and an iron powder magnetic coating layer which is 3 microns thick. A superior tape will soon be available in which an evaporated metal coating only 0.15 microns thick will be used. This new coating will provide superlative high frequency performance and much higher mechanical stability.

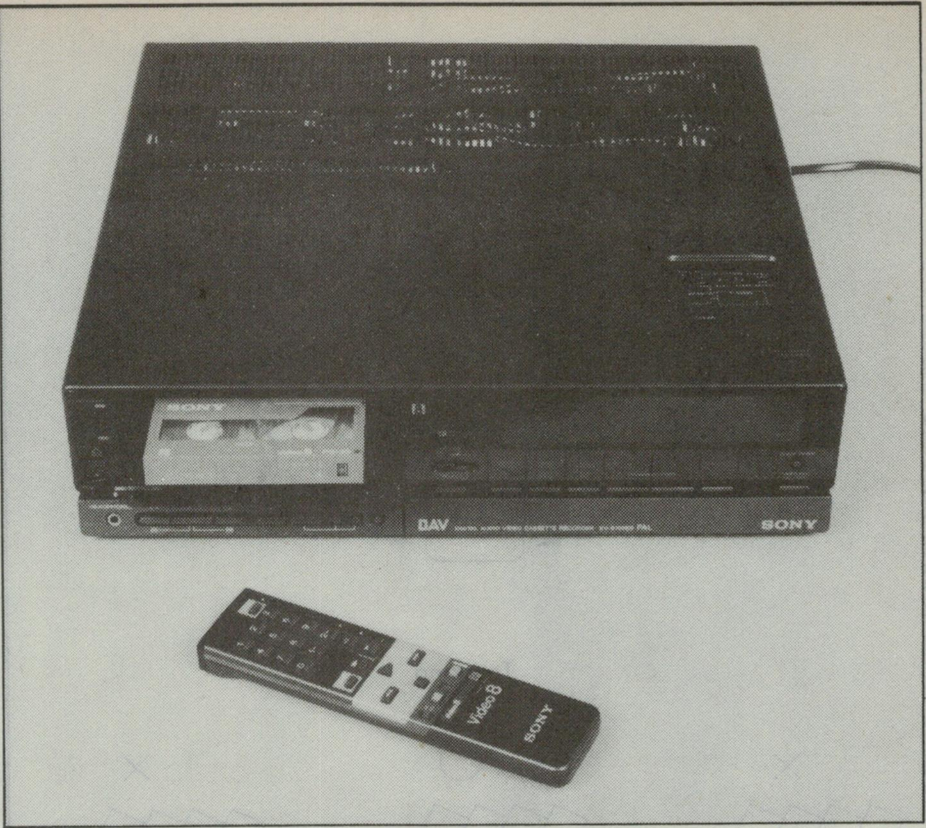
The format of the recording system used with a Video 8 recorder is based on two video heads mounted on the opposite sides of a rotary head drum. Of each half drum rotation, 150° is devoted to the video signal and the remaining 30° is allocated for the pulse code modulated (PCM) audio signal component (see Figure 1). This arrangement is in sharp contrast to the conventional VHS or Beta format VCRs which use a separate stationary head for the monophonic FM sound track on one side of the tape.

The innovative tracking system used in the Video 8 system was developed by

SONY EV-S700ES DIGITAL AUDIO VIDEO (VIDEO 8)

Dimensions:	*355 mm (wide) x 95 mm (high) x 342 mm (deep)*
Weight:	*7.3 kg*
Accessories:	*Remote Commander type RMT-405 coaxial video cable*
Manufacturer:	*Sony Corporation, Japan*
RRP:	*$1899 (anticipated)*

Louis Challis



Philips at Eindhoven and has been aptly named the Automatic Track Finding (ATF) system. It works on the basis of recording each one of the four pilot signals (f_1 to f_4) side by side on each video track. The f_1 signal is recorded by the Channel 1 (CH1) head, f_2 by CH2, f_3 by CH1 and f_4 by CH2 (see Figure 2). Thus f_1 and f_3 are recorded by the same head CH1, and f_2 and f_4 alternately by CH2. During playback the rotating video head detects the pilot signals on the adjacent track and compares the level of these signals.

There are several advantages of the ATF system. Firstly, because the conventional stationary CTL head is deleted, the need to provide highly accurate positioning of the CTL head relative to that of the rotating drum is avoided. Secondly, any expansion or contraction of the tape as a result of differential tensioning or thermal effects does not affect the tape tracking. Thirdly, the loading of the tape is simplified because the tape path mechanism is somewhat simpler. And, fourthly, the need for users to adjust tape tracking to take into account the differences between the playback machine and the recording machine are completely avoided.

Although the new hi-fi video (see ETI, November 1984) provides an excellent audio capability, the effective recording time is still limited to the basic video recording time. By contrast, the Video 8 system provides us with a brand new and dramatically expanded capability. We now have the option of either interleaving the PCM signal and a video signal with five-sixths of the time allocated to video and one-sixth to audio, or allocating all the recording time to the PCM audio, expanding audio recording time by six.

It can even be expanded by another 100% if you are prepared to use the LP (slow speed) mode. A P5-90 tape can provide an almost unbelievable *18 hours* of stereo recording and playback in the LP mode or *nine hours* in the SP (standard play) mode. The only catch is that this requires six separate passes through the tape recorder (without turning the tape over) rather than being a continuous 18 hours non-stop recording. Obviously this may not be what you expected, but it isn't all that different from a multi-track recorder and the system can probably be expanded into a 12 track machine.

The CD system and earlier PCM adaptors used with VHS and Beta format VCRs incorporated 44.1 kHz sampling frequencies, however the designers of the 8 mm DAV system have elected to use a 31.25 kHz PCM sampling frequency. The resulting audio bandwidth capability of the Video 8 DAV PCM channels is consequently only 15 kHz. This limited bandwidth capability has been deliberately chosen to meet the primary audio requirements of TV. These conveniently place the audio bandwidth below the 16.25 kHz line sampling frequency, thereby avoiding interference problems. Notwithstanding its limitations, a 15 kHz bandwidth effectively covers more than 99% of the time-related usable audible bandwidth of classical or pop music and the perceived loss of audible content is almost inconsequential.

Appearance

The first impressions of the front panel of this unit are quite deceptive for, although it looks like a lamb, it is very much a 'wolf in sheep's clothing'.

The POWER ON/STANDBY switch is on the left hand side of the front panel. This surmounts a cassette EJECT button and a tiny headphone volume control. To the right is a very neat electronically activated, compact, loading cassette well. The cover requires the use of a very small eject button to open it. Immediately below the cassette well are five primary elongated control switches for REWIND, PLAY, FAST FORWARD, STOP and PAUSE. The pause button also provides a still picture during video playback. Each of these control switches is relatively small.

Adjacent to these are three very small pushbuttons. The first of these is STEP which provides a step-by-step playback picture in the playback pause mode. Next is a SLOW button which provides a one-fifth speed playback picture, and lastly a x2 button which provides a double speed playback picture.

At the top centre of the panel is the remote control sensor, below which is the record button which also activates a red indicator light to confirm that recording is taking place. On the extreme right hand side of the unit is the functional display panel which provides the following comprehensive data: whether or not multi-PCM recording is available and on which channel recording is taking place; the day of the week and time (in hours and minutes) as ▶

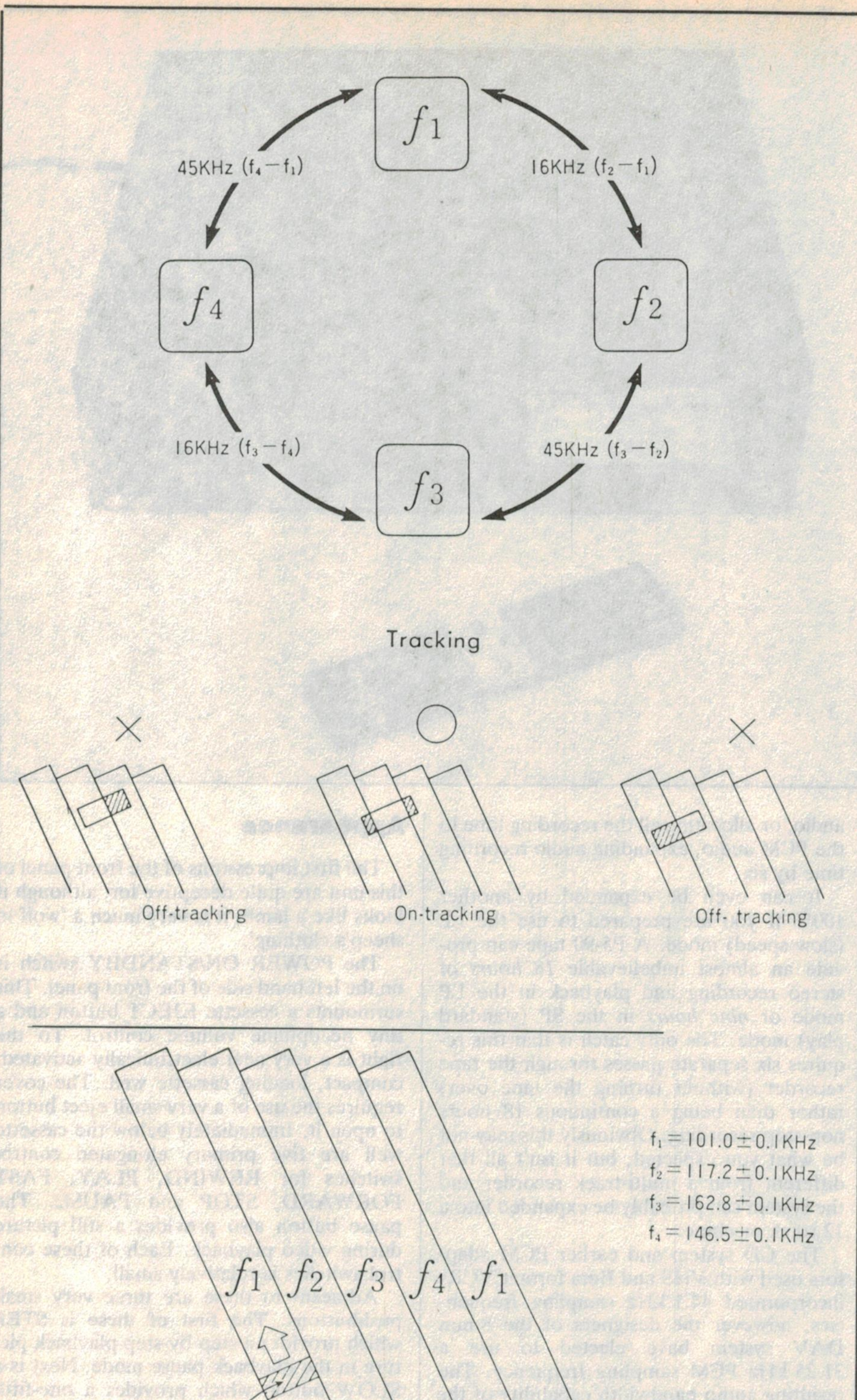


Figure 2. Automatic track finding.

well as data on forward timing for turn-on and turn-off programming time, when requested; the peak level meter display for left and right channels covering −40 dB to +5 dB; information as to whether conventional stereo, bilingual or mono reception is taking place; which channel number has been selected; whether the input is from a tuner, line, simulcast or audio; and if the recording mode is standard play or long play.

The secondary controls include a FUNCTION button which switches the display between COUNTER, TAPE REMAINING or CLOCK COUNTER, and other controls for the COUNTER RESET, for TV/VTR, and programming the channel number with switches labelled '+' and '−'.

At the bottom right hand portion of the front panel is a spring-loaded cover behind which are tertiary controls for selecting the clock reset, mode of play, PCM monitoring switches and input mode which selects inputs from tuner, line, simulcast or audio as well as the SP or LP modes. The audio monitor switches also provide for PCM monitoring of a tape which has been recorded with bilingual sound for FM simulcasts or monitoring an audio dubbed tape (either full PCM or standard track playback).

Adjacent to these controls is a switch for audio dubbing which, if pressed during playback pause mode, enables you to record music or commentary on the PCM track of a pre-recorded video tape. Immediately to the right is a recording level control which automatically sets the recording level if the two slide controls remain at the extreme left hand position and provides full attenuator controls. At the extreme right hand end of the flip-down panel are two 3.5 mm diameter tip and sleeve sockets which cater for inputs from external low impedance microphones.

On top of the recorder is a small plastic cover behind which are a series of video controls. The first of these is a small screwdriver slot, which allows you to stabilise still pictures. The second is the AFT switch, which is normally set to ON and facilitates automatic fine tuning to lock-in and maintain a sharp picture. The third is a SEARCH ON/OFF button which has to be activated to preset each of the numbered tuner channels. The fourth is a clear button which allows you to erase the preset station information. The fifth is an auto-stereo ON/OFF switch which is normally set to ON; during stereo broadcasts the reception is automatically set to stereo. The sixth is a sharpness control to adjust the clarity of picture, while the seventh is a pair of tuning buttons. Once pressed, these automatically search up or down in frequency for the next TV station carrier frequency.

The rear, sides and underneath of the

cover and chassis are slotted to allow adequate ventilation for the copious quantity of circuitry within. The rear panel contains a pair of video 75 ohm sockets for aerial input and output, but unlike other VCRs does not provide BNC sockets for connection to a video monitor. Instead it contains a 21-pin Euroconnector which greatly simplifies this task. Four RCA coaxial sockets are provided for left/right channel inputs and outputs, and two small switches provide for test signal generation as well as for local or DX video reception.

The remote control is slim, neat and effective. It provides direct channel changes for up to 30 preset TV channels as well as control of the primary deck functions, record functions, still picture, STEP and x2. It operates well at distances of up to 10 metres and over angles of ±30°.

Although the description of these features may seem superfluous when our interest is in the audio capabilities of the recorder, they nonetheless provide you with useful information on the total capabilities of this feature-packed recorder. More significantly, prior to using the unit for audio recording, you have to be fully aware of the controls and their multi-functional uses.

The handbook for the VCR contains 34 pages of relatively complex and detailed instructions, but the service manual (which Sony fortunately provided) proved to be a veritable textbook with 274 pages of circuit diagrams and disassembly instructions. With a piece of equipment as complex as this, the servicing instructions obviously have to be very comprehensive.

Objective testing

The objective testing of the digital audio section of the unit proved to be quite straightforward. When recording a continuous sweep of 0 VU in the SP mode, which the handbook advises is the maximum recording level, the pre-emphasis circuit results in an observable non-linearity over the frequency range 5 kHz to 15 kHz.

When the sweep is recorded at −6 dB this characteristic disappears and you are left with a signal which is particularly smooth and better than ±2 dB from 20 Hz to 20 kHz. This characteristic remains unchanged all the way down to −80 dB where noise affects the measurements. The low frequency record-to-replay characteristics of the recorder are particularly interesting as the recorder does not display any trace of the non-linearity of a conventional magnetic tape recorder and the low frequency response is remarkably smooth. At 10 Hz the frequency response is 10 dB down and at 5 Hz the response is 20 dB down.

The LP mode frequency response does not change from that measured in the SP mode and is still 20 Hz to 15 kHz ±2 dB with a linearity which is still almost ruler flat.

I carefully checked the linearity between 0 dB and −90 dB which proved to be better than I have measured on typical CD players, particularly over the range −60 to −90 dB. This good result correlated reasonably well with the measured distortion figures of less than 0.5% all the way through to approximately −60 dB but which rise rapidly thereafter. At the lowest levels the distortion products are still well below the noise and generally inconsequential.

The measured signal-to-noise ratio of the unit relative to 0 dB is 78 dB unweighted and −88.5 dB(A) [Sony, it should be noted, quotes a figure of −88 dB(A)]. This dynamic range effectively cuts out the requirement to adjust volume controls for more than 70% of all typical recording situations.

The measurement of the wow and flutter proved to be a very difficult task and all that we could confirm in the end was that they are both most certainly less than 0.005% rms quoted in the specification sheet.

The cross-talk between Channel A and Channel B is −111 dB at 1 kHz, −58.4 dB at 10 kHz and −86.9 dB at 100 Hz, which is excellent. The erasure ratio at 1 kHz is −117 dB which is also excellent.

I carried out one supplementary test to measure the replay linearity using a 1 kHz signal recorded at −60 dB. This was intended to determine whether the unit exhibits any measurable drop-out or other nasty drift characteristics. Far from it; if one ignores the small and inconsequential level of superimposed noise, it is clear that the output is rock-steady and substantially better than that provided by any conventional magnetic tape recorder.

Taken overall, the objective test results proved to be outstanding and fully in keeping with what I would expect from a PCM digital recorder.

Because the Video 8 DAV recorder had to be evaluated at home I decided to check its video performance before starting the audio performance evaluation. I directly ▶

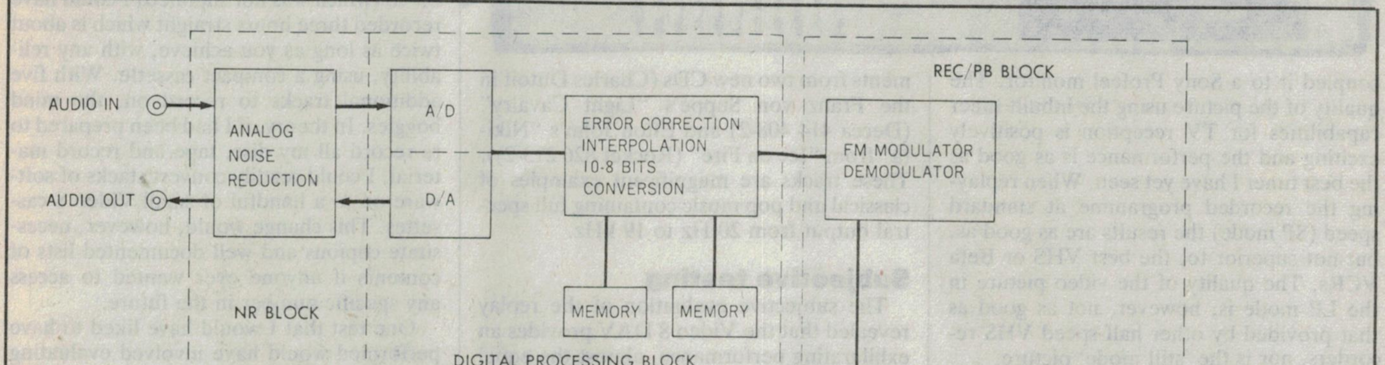
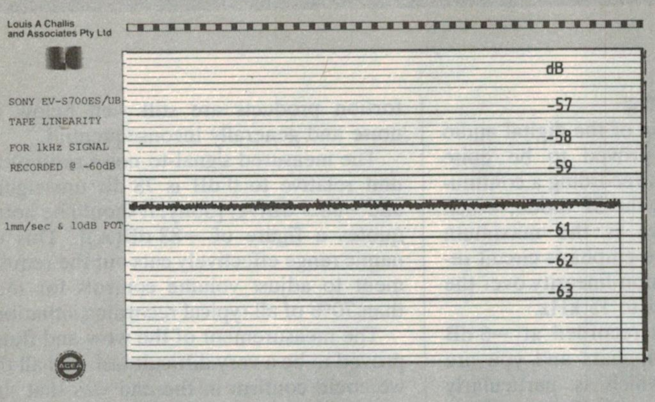
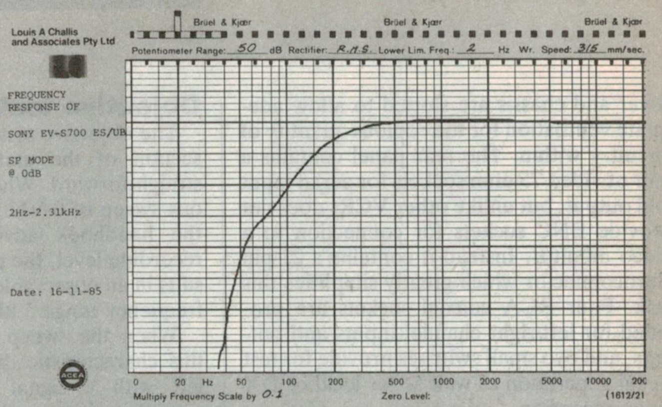
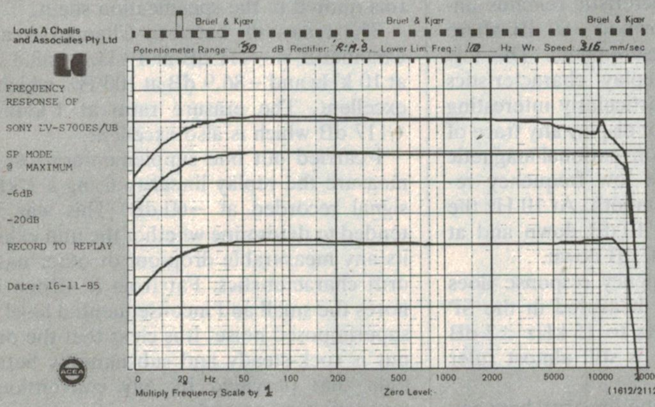
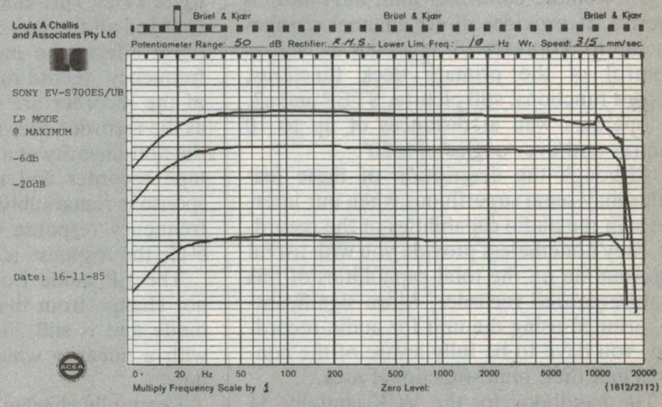


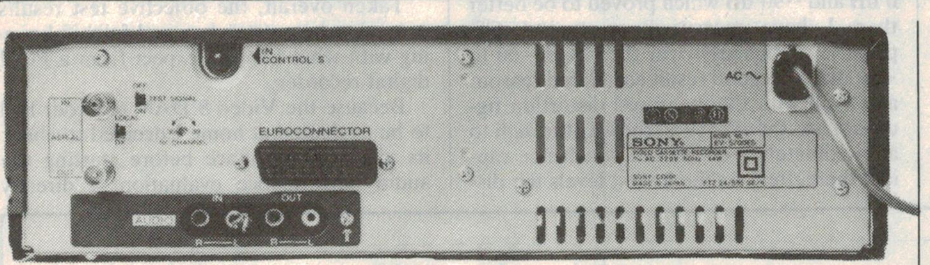
Figure 3. Block diagram for PCM.











coupled it to a Sony Profeel monitor. The quality of the picture using the inbuilt tuner capabilities for TV reception is positively exciting and the performance is as good as the best tuner I have yet seen. When replaying the recorded programme at standard speed (SP mode) the results are as good as, but not superior to, the best VHS or Beta VCRs. The quality of the video picture in the LP mode is, however, not as good as that provided by other half-speed VHS recorders, nor is the 'still mode' picture.

In all other respects, however, the video performance is 'grade A' and most certainly approaching the level of a professional recorder.

The audio evaluation comparison was performed against a Nakamichi Dragon compact cassette recorder. The Dragon provides a quality of performance which virtually no other compact cassette recorder can presently eclipse. Its frequency response is better than ±2 dB from 10 Hz to 23 kHz and its dynamic range (in the Dolby C mode) is 78 dB(A).

I recorded a series of programme segments from two new CDs (Charles Dutoit in the Franz von Suppé's "Light Cavalry" (Decca 414 408-2) and Elton John's "Nikita" from "Ice on Fire" (Rocket 826 213-2)). These tracks are magnificent examples of classical and pop music containing full spectral output from 20 Hz to 19 kHz.

Subjective testing

The subjective evaluation of the replay revealed that the Video 8 DAV provides an exhilarating performance, almost the equal of any professional audio recorder I have yet heard. The first thing that I became aware of was the *total absence* of background noise (except with ears glued to the monitor speakers) and that the residual level is perceptibly lower than that provided by the best compact cassette players (such as the Nakamichi Dragon) operating with Dolby C.

The frequency response limit of 15 kHz results in an almost imperceptible change in the audible quality of some musical content. However, I had to listen very carefully to be able to detect it, and even then it had to be in an A-B test format. My son could detect the difference more readily than I could (ah — such is youth).

The point that most impressed me was that I could record a straight two-hour track of superlative music on a P5-60 cassette without having to turn the tape over. With a P5-90 (which was not supplied) I could have recorded three hours straight which is about twice as long as you achieve, with any reliability, using a compact cassette. With five additional tracks to record on, the mind boggles. In theory, if I had been prepared to re-record all my disc, tape and record material, I could readily convert stacks of software on to a handful of small Video 8 cassettes. This change would, however, necessitate copious and well documented lists of contents if anyone ever wanted to access any specific number in the future.

One test that I would have liked to have performed would have involved evaluating the long-term capabilities of the Video 8 DAV on LP replay mode after hundreds or even thousands of hours of operation. While I am reasonably sure that the performance in the SP mode would remain free of drop-out problems, I am still a trifle apprehensive as to what the performance would be like in the LP mode. That test is obviously one that will ultimately require practical evaluation, and in due course I would appreciate being advised on the results from one of our readers.

The Sony Video 8 DAV is a truly fabulous machine. It offers a range of technical

capabilities which almost border on the sublime. Had the designers chosen a higher sampling frequency, every small amateur and professional studio would have rushed out to buy one (or more). As it happens, the more limited frequency response does not really justify any technical condemnation because virtually all of the material likely to be recorded in real situations contains so little by way of practical information above 15 kHz. In the end, I suspect more people are likely to buy the EV-S700ES for its digital audio than those who buy it for its far from basic VCR capabilities. ●

MEASURED PERFORMANCE OF SONY EV-S700ES VIDEO 8 DIGITAL AUDIO VIDEO CASSETTE RECORDER

Serial No. FTZ 24/585 SE/K

Measured Frequency Response (independent of level except in the range 0 VU to -6 VU where pre-emphasis affects the frequency response) LP and SP mode - 20 Hz to 15 kHz $\pm$2 dB.

LINEARITY (SP mode)

INPUT LEVEL dB	OUTPUT LEVEL dB
0.0	0.0
-1.0	-1.0
-2.0	-2.0
-3.0	-3.0
-6.0	-6.0
-10.0	-10.0
-20.0	-20.1
-30.0	-30.1
-40.0	-40.1
-50.0	-49.7
-60.0	-59.5
-70.0	-69.4
-80.0	-79.1
-90.0	-88.8

DISTORTION @ 1 kHz (SP mode)

Input Level	2nd	3rd	4th	5th	%
0.0	-58.3	-71.8	-	-	0.12
-3.0	-	-	-69.0	-	0.035
-6.0	-65.8	-	-66.3	-67.2	0.083
-10.0	-57.1	-62.9	-	-	0.16
-20.0	-53.6	-65.3	-	-	0.22
-30.0)					
-40.0)	Distortion components below noise threshold.				
-50.0)					
-60.0	-	-	-44.9	-	0.57
-70.0	-	-	-35.1	-	1.76
-80.0	-	-	-23.5	-	6.7
-90.0	-	-	-14.7	-	18.4

SIGNAL TO NOISE RATIO re 0 dB @ 1 kHz : 79.0 dB (Lin) 88.5 dB(A)

ERASURE RATIO
(for 1 kHz signal recorded at 0 VU) -117 dB

CROSSTALK

Channel A into Channel B	@ 100 Hz	-86.9 dB
	@ 1 kHz	-111 dB
	@ 10 kHz	-58.4 dB

Check our test equipment range!

Suitable for schools, OEM's, manufacturers, etc.

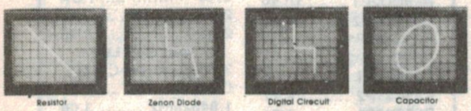
Includes two free probes!

12 months warranty!

HUNG CHANG (RITRON) 20 MHz DUAL TRACE OSCILLOSCOPE

- Wide bandwidth and high sensitivity
- Internal graticule rectangular bright CRT
- Built in component tester
- Front panel trace rotater
- TV video sync filter
- Z axis (Intensity modulation)
- High sensitivity X-Y mode
- Very low power consumption
- Regulated power supply circuit

COMPONENT TESTER is the special circuit with which a single component or components in circuit can be easily tested. The display shows faults of components, size of a component value, and characteristics of components. This feature is ideal to troubleshoot solid state circuits and components with no circuit power. Testing signal (AC Max 2 mA) is supplied from the COMPONENT TEST IN terminal and the result of the test is fed back to the scope through the same test lead wire at the same time.



Resistor   Zenon Diode   Digital Circuit   Capacitor

CRT

CRT: 6" (150mm) Flat-faced high brightness CRT with Internal Graticule.
Effective display area: 8 x 10 div (1 div = 10 mm)
Acceleration potential: 2KV

VERTICAL

Operating Modes: CH-A, CH-B, DUAL, ADD (CH-B can be inverted.)
Dual modes: Alter; 0.2uS - 0.5ms/div. Chop; 1ms - 0.5s/div.
CHOP frequency 200KHz approximately.
Deflection factor: 5mV/div 20V/div +/−3%, 12 ranges in 1-2-5 step with fine control.
Bandwidth: DC; DC - 20MHz (−3dB). AC; 10Hz - 20MHz −3dB).
Rise Time: Less than 17ns.
Overshoot: Less than 3%.
Input Impedance: 1M ohm +/−5%, 20pF +/−3pF
Maximum Input Voltage: 600Vp-p or 300V (DC+AC Peak).
Channel Isolation: Better than 60 dB at 1KHz.

HORIZONTAL

Sweep Modes: NORMAL, and AUTO
Time Base: 0.2uS - 0.5s/div +/−3%. 20 ranges in 1-2-5 step with fine control.
Sweep Magnifier: 5 times (5X MAG).
Linearity: 3%.

TRIGGERING

Sensitivity: INTERNAL: 1 div or better for 20Hz - 20MHz (Triggerable to more than 30MHz). EXTERNAL: 1Vp-p or better for DC - 20MHz (Triggerable to more than 30MHz).
Source: INT, CH-A, CH-B, LINE and EXT.
Slope: Positive and Negative, continuosly variable with level control PULL AUTO for free-run.
Coupling: AC, HF-REJ and TV. TV SYNC Vertical and Horizontal Sync Separator Circuitry allows any portion of complex TV video waveform to be synchronized and expanded for viewing TV-H (Line) and TV-V (Frame) are switched automatically by SWEEP TIME/DIV switch.
TV-V:0.5s/div to 0.1ms/div. TV-H:50uS/div to 0.2uS/div.

X-Y OPERATIONS

X-Y Operations: CH-A: Y axis. **CH-B:** X axis Highest Sensitivity: 5mV/div.

COMPONENT TESTER

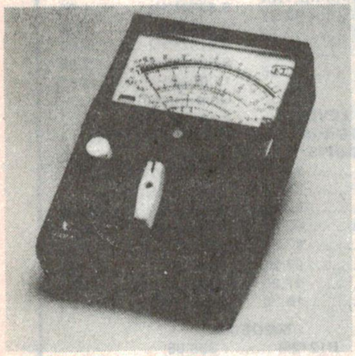
Component Tester: Max AC 9V at the terminal with no load. Max current 2mA when the terminal is shorted. (Internal resistance is 4.7K ohm)

OTHER SPECIFICATIONS

Intensity Modulation: TTL LEVEL (3Vp-p); Positive ...... brighter.
BANDWIDTH; DC - 1MHz MAXIMUM INPUT VOLTAGE: 50V (DC+AC Peak)
Calibration Voltage: 0.5Vp-p +/−5%, 1KHz +/−5% Square wave.
Trace Rotation: Electrically adjustable on the front panel.
Power Requirements: AC; 100, 120, 220, 240V 20W
Weight: 7kg approximately.
Size: 162(H) x 294(W) x 352(D)mm.

Cat. Q12105 .... **only $695**
(tax exempt only $595)

Bulk orders, schools, please phone (03) 543 2166 for special low pricing.

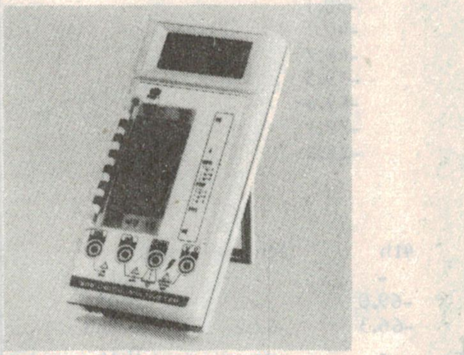


ANALOG WORKHORSE KT370

FEATURES:
- Fuse and diode protection
- hFE measurements 0 - 1000 (by x 10 range)
- Mirror scale for more accurate reading

SPECIFICATIONS
Ranges:
DC Voltage: 0 – 0.1, 0.5, 2.5, 10, 50, 250, 1000V (20k ohm/V)
AC Voltage: 0 – 10, 50, 250, 500V, 1000V (8k ohm/V)
DC Current: 0 – 0.05, (50uA), 2.5, 25, 250mA
Resistance: 0 – 2K, 20K, 2M, 20M ohm
Load Current: 0 – 150uA, 15mA, 150mA
Load Voltage: 0 – 3V
Volume Level: − 10 – + 22dB – + 62dB
DC Current Amplification Factor (hFE) 0 – 1000
ACCURACY
DC Voltage & Current: Within +/−3% f.s.
AC Voltage: Within +/−4% f.s.
Resistance: Within +/−3% of arc.
Battery: 1.5V (um-3) 2pcs. 9V (oo6p) 1pc.
Fuse: 0.5A, 5ø x 20mm
Diode: 4148 x 2
C.C. .04uff x 50V
Size & Weight: 147 x 99x 57mm & 400g approx.
"The same type as I have carried in my toolbox since I started in electronics 15 years ago."
- Rod Irving

Cat. Q11030 .... **$27.95**



605 3½ DIGIT MULTIMETER

(New replacement for YF1100)

Cat. Q11035 .... **$79.95**

SPECIAL INTRODUCTORY OFFER $99 TO FIRST 100 CUSTOMERS!

705A 3½ DIGIT MULTI/CAPACITANCE METER

Cat. Q11040 .... **$119**

605 & 705A SPECIFICATIONS

DC Voltage

Range	Resolution	Accuracy 605	Accuracy 705A	Input impedance	Overload Protection
200mV	100μV	0.5%·1	0.5%·1	10MΩ on all ranges	1000V DC/peak AC on all ranges
2V	1mV				
20V	10mV				
200V	100mV				
1000V	1V	0.8%·1	0.8%·1		

AC Voltage

Range	Resolution	Accuracy (50-500 Hz) 605	Accuracy (50-500 Hz) 705A	Input Impedance	Overload Protection
200mV	100μV	1%·4	1%·4	10MΩ on all ranges Capacitance 1000pF	750V rms on all ranges except 200mV AC ranges (15 seconds max above 250V rms AC)
2V	1mV				
20V	10mV				
200V	100mV				
750V	1V	2%·4	2%·4		

DC Current

Range	Resolution	Accuracy 605	Accuracy 705A	Burden Voltage	Overload Protection
200μA	100nA	NC	1%·1	0.3V max	705A: 0.2A fuse up to 250V 605 2A fuse up to 250V 10A range not fused
2mA	1μA	1%·1			
20mA	10μA				
200mA	100μA				
2000mA	1mA	1.5%·1	NC		
10A	10mA	1%·1	1%·1	0.7V max	

NC = Not Connected

AC Current

Range	Resolution	Accuracy (50-500 Hz) 605	Accuracy (50-500 Hz) 705A	Burden Voltage	Overload Protection
200μA	100nA	NC	1.2%·4	0.3V max	705A: 0.2A fuse up to 250V 605 : 2A fuse up to 250V 10A range not fused
2mA	1μA	1.2%·4			
20mA	10μA				
200mA	100μA				
2000mA	1mA	2%·4	NC		
10A	10mA	1.5%·4	1.5%·4	0.7V max	

Resistance

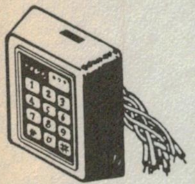
Range	Resolution	Accuracy (Hi) 605	Accuracy (Hi) 705A	Open Voltage	Overload Protection
200Ω	100mΩ	1%·2	1%·2	HiV · 3.5V LoV · 0.25V	250V DC rms on all ranges
2KΩ	1Ω	0.8%·2	0.8%·2		
20KΩ	10Ω				
200KΩ	100Ω				
2000KΩ	1KΩ				
20MΩ	10KΩ	2%·4	2%·4		

Capacitance

Range	Resolution	Accuracy 605	Accuracy 705A	Test Signal	Max. Input
2nF	1pF	NC	3.5%·4	400mV rms	3V DC/peak AC on all ranges
20nF	10pF			512 Hz 40mV rms	
200nF	100pF				
2000nF	1nF				
20μF	10nF				

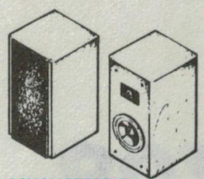
NEW! NEW! NEW! NEW!

an entire page full of NEW products! from Rod Irving Electronics!



CODE KEY PAD
- Telephone type digital keypad.
- Four digit, changeable code.
- Over 5000 possible combinations.
- Power consumption: 5mA standby, 50mA alarm.
- Two sector LED and 1 arm LED.
- Wrong number lockout.
- 12V DC operation.
- Relay output.
- Panic button.
- Normally open tamper switch.
- Dimensions: 145 x 100 x 37mm
- ACP3 compatible.

Cat. A13014 **$69.50**



2 WAY MID SIZED SPEAKER SYSTEM

Designed specifically for compact disc. Excellent bass response to fully utilize the output capabilities of a compact disc. 16" high, woodgrain finish cabinet with brown cloth grille.

SPECIFICATIONS:
Speakers: Woofers 6 1/2" carbon fibre reinforced polypropylene cone 10oz magnet. Tweeter 1" soft dome 6oz damped with ferro fluid.
Power Input: 40 watts rms 85dB w/m
Impedance: 8 ohms
Frequency response: 50-20,000Hz
Size: 250 x 400 x 240mm
(AVAILABLE MAIL ORDER ONLY)

Cat. C10762 **$299**

WIRELESS INTERCOM

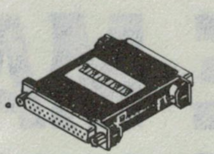
This quality 2 way handset type FM wireless intercom, automatically calls the other phone the moment the handset is picked up. Simply plugs into any 240V wall outlet and can be wall or bench mounted. Features LED indicators for transmit and recieve, and P.L.L. circuitry to ensure reliability. Carrier frequency 95,125kHz.

Cat. A11506 **$139**

3HR VIDEO TAPES from only $6.95!

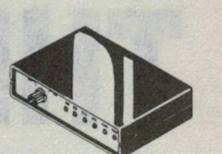
Rod Irving Electronics has made a sensational scoop purchase of quality Kyoto video tapes at unheard of prices!

1-9	10-24	25+
$8.95	$7.95	$6.95



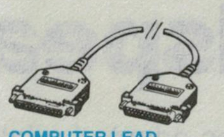
INLINE SWITCHING BOX
- 25 pin "D" plug to 25 pin "D" socket (RS232)
- DIP switches allow easy switching of internal wiring.

Cat. P00000 **$32.95**



RS232 DATA SWITCH WITH TESTER
- 25 pin RS232 "D" connectors 2 in, 1 out or 1 in, 2 out.
- Ideal for 2 computers to one peripheral or 1 computer to 2 peripherals.
- No power required.
- Six dual coloured LED indicators showing certain flow status:
  T.D. Transmit Data
  R.D. Recieve Data
  R.T.S. Request To Send
  C.T.S. Clear To Send
  D.S.R. Data Set Ready
  D.T.R. Data Terminal Ready
- Housed in heavy duty metal cabinet.
- Size: 200(W)x68(H)x150(D)mm

Cat. X19110 **$149**

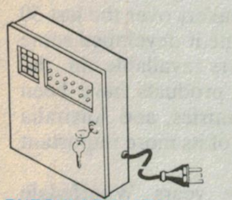


COMPUTER LEAD
- 25 pin "D" plug to 25 pin "D" plug (RS232) DIP switches in each plug allow many combinations of internal wiring, making this a truly universal lead.
- Mylar shielding against RF interference.
- Length 2 metres.

Cat. P19031 **$59.95**

CENTRONICS DATA SWITCH WITH TESTER
- 36 pin gold plated female Centronics connectors.
- All other specs as for RS232 Data Switch with Tester.

Cat. X19115 **$169**

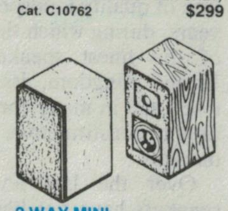


BURGULAR ALARM CONTROL PANEL

A complete six sector alarm control panel suitable for both commercial and residential use. Has all the features of larger units in a compact tamper proof metal cabinet. Inbuilt 240V - 50Hz power supply.
- Armed and Disarmed with digital keypad.
- Six independent supervised zone inputs.
- Will accept N/O or N/C sensors.
- Each is supervised with end of line resistor.
- LED indicator for each sector plus LED indicators for zone violation.
- May be either delayed or instant zones.
- Separate zones may be disabled for service etc.
- Two 24 hour zones. One is N/O for panic or fire alarm, the other is N/C for motion detector or siren box. Both are supervised with end of line resistors.
- Built-in Anti tamper switches.
- N/C tamper switch on front and rear.
- Audible alarm status indicator.
- Internal buzzer sounds for exit/entry delays.
- Internal buzzer for low battery and testing.
- Built-in siren driver output circuit.
- External horns have wire cut protection.
- Relay outputs.
- Timing relay - dry contact output (SPDT).
- Timing relay - 12V DC output.
- Latching relay - 12V DC output, 500mA
- Regulated 12V DC output (1 amp maximum) for passive or active detectors. Short circuit protection.
- Backup battery circuit.
- Automatically charges backup battery.
- Built in test switch enables the sensors etc., to be tested without causing the sirens to go off.
- Phase II continual protection except for 24 hour zone.
- LED indication of mains failure.
- Dimensions 300 x 270 x 80mm.

Mail Order Only

Cat. S13013 **$269**



2 WAY MINI BOOKSHELF SYSTEM

Designed specifically for compact disc. This 2 way bass reflex system offers incredible audio performance for its size (9.5"). Woodgrain cabinet allows it to slot in with any audio or video system.

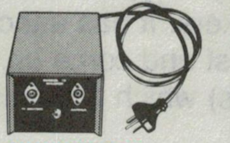
SPECIFICATIONS:
Speakers: Woofer - 4" carbon fibre reinforced polypropylene cone 10oz magnet. Tweeter 1" soft dome 6oz magnet, damped with ferro fluid.
Power input: 30 watts rms 82dB w/m
Impedance: 8 ohms
Frequency response: 80-20,000Hz
Size: 150 x 240 x 160mm
(AVAILABLE MAIL ORDER ONLY)

Cat. C10760 **$179**

OMNI-DIRECTIONAL WIRELESS MICROPHONE

Tuneable: 92 - 104MHz
Freq. Response: 50 - 15kHz
Range: Over 300 feet in open field.
Modulation: FM
Power Source: 9V Battery
Type: Electret Condenser.
Dimensions: 185 x 27 x 38mm
Weight: 160 grams

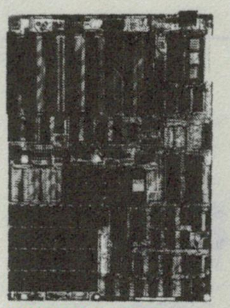
Cat. A10450 **$19.95**



CHANNEL 28 TO CHANNEL 0 CONVERTER

If your TV doesn't have UHF, don't despair! With one of these high quality, specially made converters you can have Channel 28 UHF converted to Channel 0 VHF.

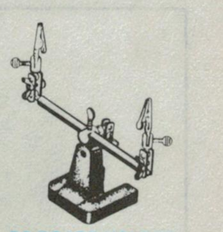
Cat. L15052 **$129**



IBM* COMPATIBLE MOTHER BOARD

XT compatible mother boards, 8 slots, room for 256K RAM

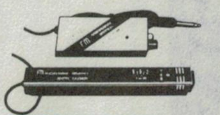
Cat. X18020 **$295**



PC BOARD HOLDER

Better than an extra pair of hands! A must for all PCB work.

Cat. T12442 **$7.95**



CRYSTAL LOCKED WIRELESS MICROPHONE AND RECIEVER

MICROPHONE SPECIFICATIONS:
Transmitting Frequency: 37.1MHz
Transmitting System: crystal oscillation
Microphone: Electret condenser
Power Supply: 9V battery
Range: 300 feet in open field
Dimensions: 185 x 27 x 38mm
Weight: 160 grams

RECIEVER SPECIFICATIONS:
Recieving Freq: 37.1MHz
Output Level: 30mV (maximum)
Recieving System: Super heterodyne crystal oscillation
Power Supply: 9V Battery or 9V DC power adapter.
Volume control
Tuning LED
Dimensions: 115 x 32 x 44mm
Weight: 220 grams

Cat. A10452 **$89**

DIGITAL SPEEDO/ DIGITAL TACHO/ SPEED ALERT
- Digital readout (LED) for both tacho and speedo.
- Alarm with sound at variable preset speed.
- Audible beeper and visual indicator.
- In built light indicator for night illumination.
- Designed for 12 volt negative earth electrical systems.
- Speedo: 0 - 199kph
- Tachometer: 0 - 9900kph
- Speed alert: 40 - 120kph
- Complete with mounting hardware.

Cat. A15064 **$69.50**

ARLEC "DISCO LITE" CONTROLLER

Give your parties a professional touch with the arlec "Disco Lite". Simply plug your light(s) into the "Disco Lite" and you've instant party life!

3 DIFFERENT MODES!
Music Mode: Place the "Disco Lite" in range of the speakers and it flashes the lights to the beat of the music!
Strobe Mode: Simply adjust to desired speed! Great for mime or theatre! The christmas season or advertising!
Dim Mode: Allows you to dim the lights to create moods, effects etc.

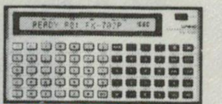
Cat. M22003 **$49.50**

ARLEC ELECTRONIC DOOR CHIME
- Quick easy installation.
- Variable tone control.
- "Ding - Dong" chime sound.
- Complete with pushbutton switch, 9 metre connecting wire and fixing screws.
- Runs approximately 12 months on one battery.
- Uses 9 volt transistor battery (Not supplied)
- 2 year guarantee.

Cat. A11950 **$25.95**

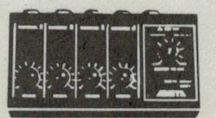
rie

ROD IRVING ELECTRONICS
425 High Street, NORTHCOTE, 3070
VICTORIA, AUSTRALIA
Phone (03) 489 8866
48 A'Beckett St, MELBOURNE, 3000
VICTORIA, AUSTRALIA
Ph. (03) 663 6151
Mail Order and correspondance:
P.O. Box 620, CLAYTON 3168
TELEX: AA 151938



CASIO FX702P BASIC PROGRAMMABLE POCKET COMPUTER
- Maximum steps: 1680 (26 memories)
- Maximum memory: 226 (80 steps)
- Alphabetical keyboard
- 19 digit display
- Comprehensive manual
- Detail programming book
- Dimensions: 166 x 82 x 18mm
- Protective pouch

$139



ECONOMY 4 CHANNEL MICROPHONE MIXER

Its size and simplicity makes this mixer very portable and easy to operate.

SPECIFICATIONS:
- 4 low impedance 600 ohm microphone inputs.
- Individual gain control for each microphone.
- Master volume control.
- Power on LED.
- Inputs/Outputs - 6.3mm mono sockets.
- DC operated (9V battery only).
- Input impedance 600 ohm.
- Output impedance 1.5kohm.
- Signal/noise ratio 55dB.
- Frequency response 20Hz to 20kHz plus or minus 2dB.
- Weight 320 grams.
- Dimension 148 x 46 x 86mm.
- Torque variable range 1-22dB.
- Input sensitivity 1mV.
- Output level 90mV (at input 5mV).
- T.H.D. 0.01%.

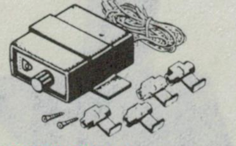
Cat. A12001 **$39.50**

MAIL ORDER HOTLINE (03) 543 7877 (2 lines)

POSTAGE RATES

$1-$9.99	$2.00
$10-$24.99	$3.00
$25-$49.99	$4.00
$50-$99.99	$5.00
$100-199	$7.50
$200-$499	$10.00
$500 plus	$12.50

This is for basic postage only. Comet Road freight, bulky and fragile items will be charged at different rates.
Certified Post for orders over $100 included "free"!
Registered Post for orders over $200 included "free"!
All sales tax exempt orders and wholesale inquiries to RITRONICS WHOLESALE, 56 Renver Rd., Clayton. Phone (03) 543 2166



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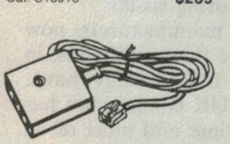

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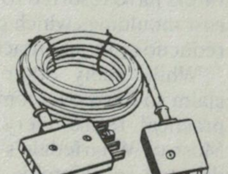

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- Dimensions: 163 x 82 x 15mm
- Protective pouch
- Options: Character printer, Cassette interface, RAM card.

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WHARFEDALE WOOS THE MARKET

— with the model 708 loudspeaker

Louis Challis

Wharfedale has adopted a fairly untypical British strategy to woo buyers of its quality speakers. It has attacked the problem of speaker cabinet cost and come up with a new material (among other changes) which it claims is significantly cheaper.

WHARFEDALE HAS BUILT up an enviable reputation for the design and construction of quality loudspeakers over the last 50 years, during which time it developed some of the finest speakers available in the United Kingdom. Its products have been marketed in many countries, and Australia used to constitute one of its more important markets.

Over the last few years Wharfedale speakers have not been marketed in Australia with quite the same enthusiasm as they were, a fact that should not necessarily be attributed to the local marketing people. The basic problem appears to be that Wharfedale, like all the other English and European manufacturers, has faced significant problems with rising costs, lower productivity and much more aggressive competition in all of its market places.

However, in response to these pressures, Wharfedale has come out with a new product line described in its glossy brochures as "the best thing since sliced bread".

Claims and designs

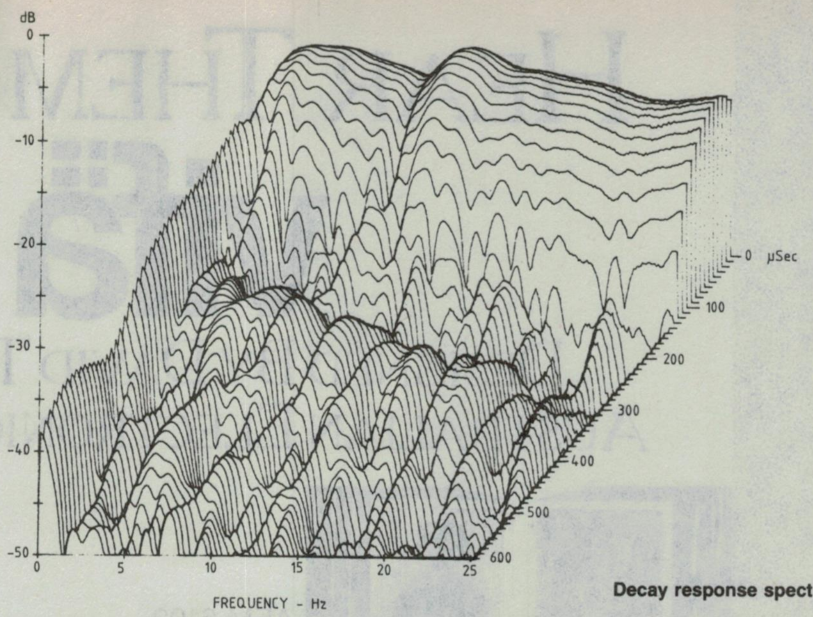
One very significant problem which most speakers have is that the speaker cabinets are expensive to manufacture and their percentage of the cost is disproportionately high in cheaper speakers. Where the drivers are expensive you can readily justify an expensive cabinet, and consequently an expensive price tag. When the manufacturer is really trying to lower his costs, the speaker drivers are the first components to be pared down, but the cabinet soon follows.

As a consequence, the more innovative of the continental and Japanese manufacturers have resorted to special plastic or die-cast moulding which can result in dramatic reductions in manufacturing costs.

While many other manufacturers now claim to have overcome these problems, in practical terms, very few actually have. Most of Wharfedale's UK competition has devoted considerable time and most of its ingenuity to reducing the cost of drivers and

WHARFEDALE MODEL 708 LOUDSPEAKERS

Dimensions:	*490 mm (high) x 250 mm (wide) x 225 mm (deep)*
Manufacturer:	*Wharfedale Ltd, Leeds*
RRP:	*$1500 (stands $145 extra)*



Decay response spectra

not nearly as much time on the cabinet design, which generally tends to be a critical element requiring much more effort in achieving a palatable solution.

Wharfedale, however, has not only reduced the cost of its drivers through the use of advanced diecasting techniques and the use of fancy ferrite magnet assemblies, but has developed an unusual technique to reduce the costs of its cabinets. This has been achieved through the use of a 'sandwich' construction in which two layers of melamine (laminex type material) are bonded to a polystyrene core which becomes 'the meat in that sandwich'. Wharfedale claims that this composite material is not only cheaper to manufacture and easier to machine, it is quicker in its assembly which thereby enables Wharfedale to market these speakers at half the price of its nearest competitor.

Such claims are most certainly 'eye-catching' but have to stand up to close scrutiny when the actual selling price is added to the equation. Amongst the attributes claimed for this composite sandwich material are that it is "lighter and more rigid than some of the most esoteric proprietary materials" available. Wharfedale also claims that it has used 'real' veneers and that the speaker has many other unusual attributes. It further claims that the new aluminium dome tweeter provides low distortion levels "with high sensitivity and relatively low cost" and that the "200 mm diameter mineral filled homopolymer polypropelene coned woofer" is hand assembled in a "Build Ring" with "computer-assisted quality control".

Now, it is quite obvious that both the tweeter and woofer are unusual because of their bayonet mountings which have been carefully designed to match the complex cut-outs in the sandwich cabinet. This has been carefully planned so as to optimise the characteristics of the polystyrene which has a natural tendency to expand and thereby to achieve a tight fit in the cabinet.

With advertising like the above, one would reasonably expect a space-age design with objective and subjective characteristics which put the system head and shoulders above all its competition. It has been my experience after more than 20 years of speaker testing and evaluation that cabinet stiffness when assessed in isolation is not the critical parameter which determines the quality of a loudspeaker's sound, but rather the combination of panel stiffness, effective damping and associated control of cabinet resonance. While Wharfedale's advertising agency would like us to belive that all you need is stiffness, stiffness without very high damping normally leads to a situation where you have one or more dominant resonant condition (or even multiple resonant conditions) and without mass normally leads to very low transmission loss characteristics.

My experimental work with testing polystyrene sandwich panels for their transmission loss has invariably shown that this material exhibits poor low frequency damping characteristics and nasty panel resonances at one or more points in the audible frequency range. Unless the speaker enclosure incorporates supplementary damping struts or added mass damping materials, the end result is normally poor and not necessarily what the designer intended. In the worst possible situation, a cabinet constructed with polystyrene sandwich structure can materially alter the overall speaker performance as a result of its re-radiation of multiple resonant frequency components that are both measurable and, more particularly, readily audible.

The 708 speaker does have other attributes including a printed circuit cross-over board, reasonable quality 4 mm binding posts and 52 strand copper wire for the internal connections. It also features a removable black mesh cloth speaker grille for which the adhesive velcro hook clips are provided on a separate piece of paper for the owner to apply him or herself (to save money). It is also available with optional speaker stands which appear to be heavier and more solid than the speakers themselves and sell for $145.

Objective testing

The objective testing of this speaker soon revealed that in an anechoic test environment the frequency response is reasonably flat from 120 Hz through to 5 kHz at 1 m from the tweeter. The measured on-axis high frequency response is, however, relatively peaky, particularly in the 10 kHz region, and displays a general droop beyond 13 kHz. The bottom end frequency response is not particularly exciting and is about all that could be expected from a simple sealed enclosure with a 200 mm diameter low frequency driver installed in such a 27.5 litre cabinet.

When measured at 2 m on the tweeter axis, the response tends to be slightly more peaky than it was at 1 m, while the off-axis response is somewhat better. The underlying cause of this improvement is not easy to track down, particularly as the frequency response curves, which were performed on the first set of speakers we evaluated, do not correlate with the polar response curves which were measured on a second set.

The step in the frequency response between 40 Hz and 120 Hz would be materially improved in a residential situation by mounting the speakers on their supplementary stands. This improvement which results from floor reflections is one characteristic which is not readily assessed in our anechoic room but will be perceived by the user after careful placement of the speakers with respect to the rear and side walls.

The measured near-field frequency response at 5 cm from the woofer and tweeter confirmed that the tweeter response is reasonably good up to 16 kHz but is starting to droop fairly fast at higher frequencies. The phase response exhibits unusual characteristics in the 0 to 3 kHz region and these unu-

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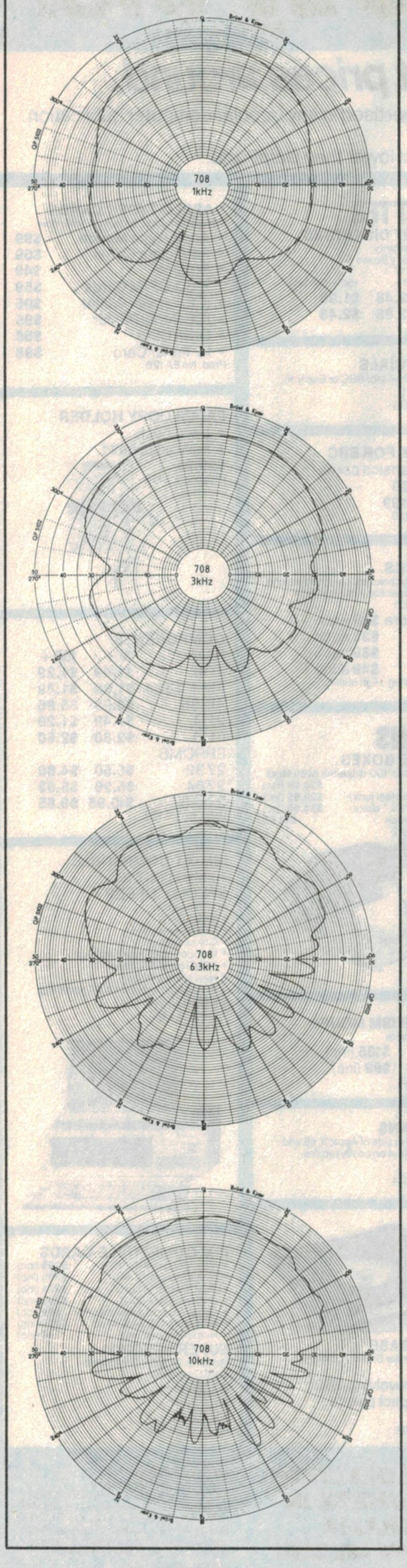
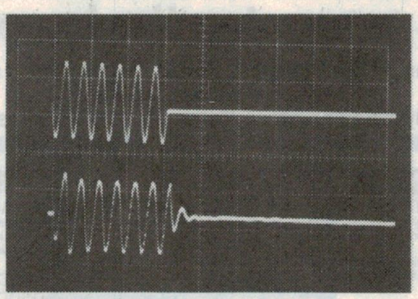
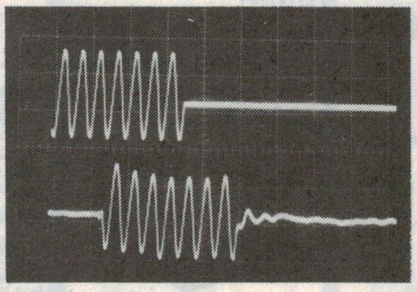
Polar response plots.



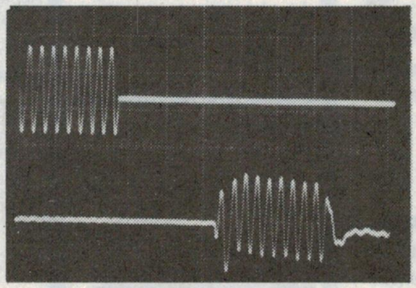
Tone response for 90 dB steady state SPL at 2 m on axis. Upper trace is electrical input; lower trace is loudspeaker output.



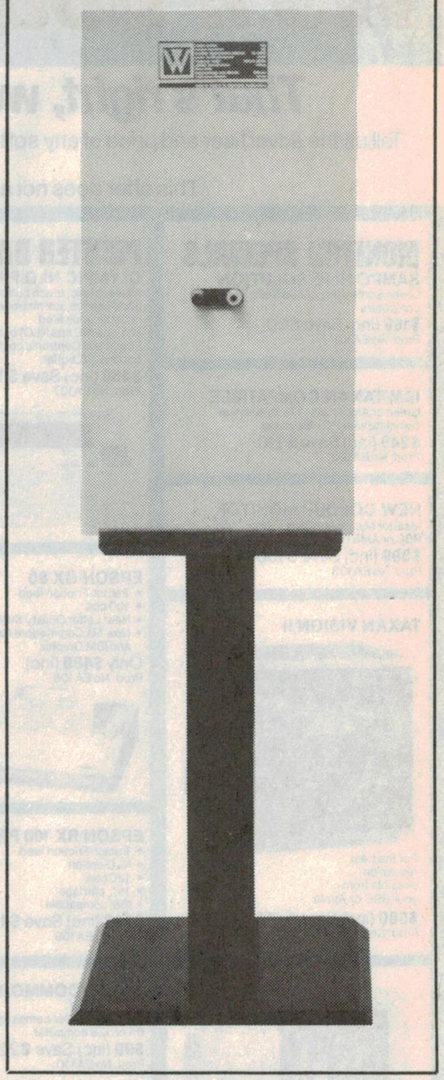
100 Hz (20 ms/div)



1 kHz (2 ms/div)



6.3 kHz (0.5 ms/div)



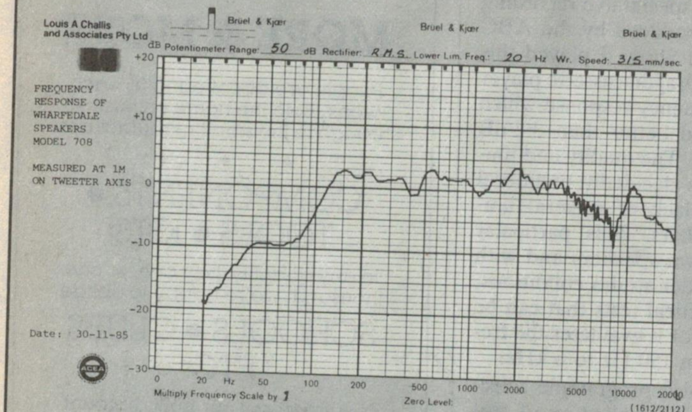
sual reversals are associated with the direct acoustical interaction between the drivers and the energy radiated by the cabinet. The tweeter, however, exhibits a particularly smooth phase response all the way up to 20 kHz. This tended to confirm that the polystyrene sandwich cabinet is stiff enough for high frequencies but not nearly good enough for the low frequency end of the spectrum.

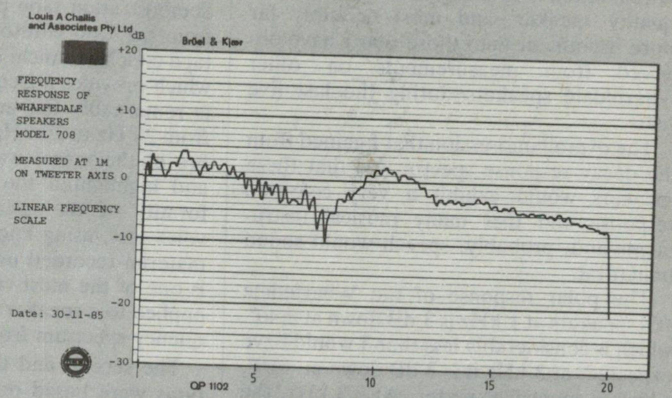
The impedance characteristics of the speaker indicate that the energy transfer will not be as good as might be expected, primarily as a result of the rising impedance characteristics between 30 Hz and 90 Hz and between 500 Hz and 3 kHz, where the impedance rises to values as high as 25 ohms. In the 5 kHz to 20 kHz region, the impedance drops below 8 ohms to an acceptable low of 6 ohms.

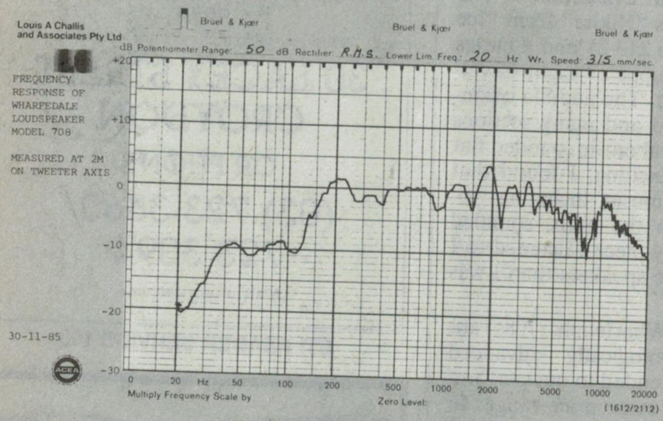
The tone burst testing exhibits transient responses for both the mid-frequencies and high frequencies where the degree of tilt concerned me somewhat. This type of characteristic is normally associated with an audible component which my (and hopefully your) ears can usually detect. This particular characteristic also normally shows up in the decay response spectra and this proved to be the case.

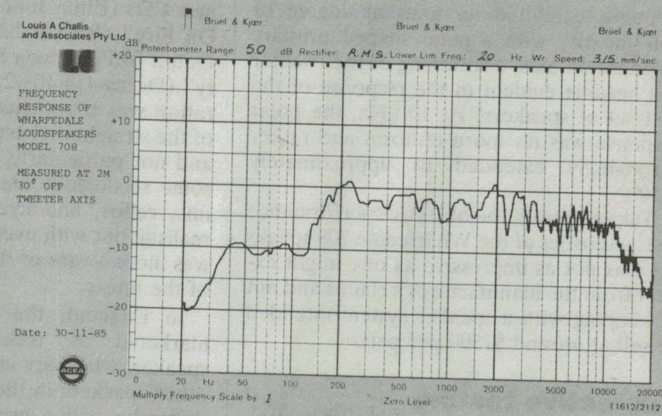
When subjected to the decay response spectra evaluation in our anechoic room, the Wharfedale 708 speaker exhibited some obvious and rather unusual resonance characteristics. These are readily observable at frequencies corresponding to approximately 2 kHz, 3.5 kHz and 10 kHz. The lowest of these frequencies is a dominant resonance associated with the driver and cabinet and observable in the measured frequency response curves recorded at both 1 m and 2 m on axis. The 3.5 kHz resonant frequency characteristic is also readily observable on- and off-axis at 2 m while the 10 kHz resonant frequency is obviously the dominant resonant frequency of the tweeter diaphragm.

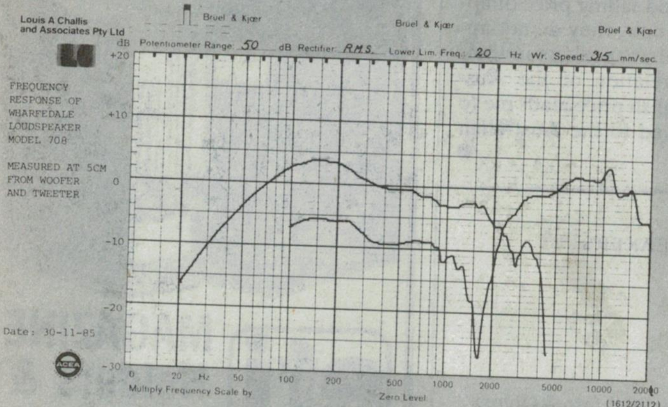
After the initial decay of the primary driver resonances, a large number of second order resonances are re-radiated by the speaker cabinet and these are not particularly well damped as the decay response spectra reveal. The broadband characteristics of these second order resonances are far ▶

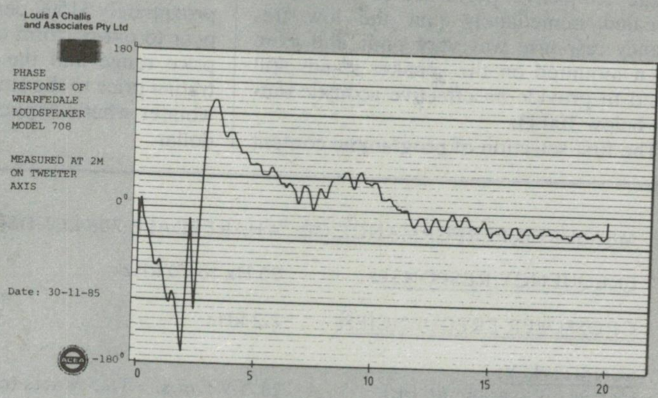

Louis A Challis and Associates Pty Ltd
Brüel & Kjær
Potentiometer Range: 50 dB Rectifier: R.M.S. Lower Lim. Freq.: 20 Hz Wr. Speed: 3.15 mm/sec.
FREQUENCY RESPONSE OF WHARFEDALE SPEAKERS MODEL 708
MEASURED AT 1M ON TWEETER AXIS
Date: 30-11-85
Multiply Frequency Scale by 1
Zero Level:

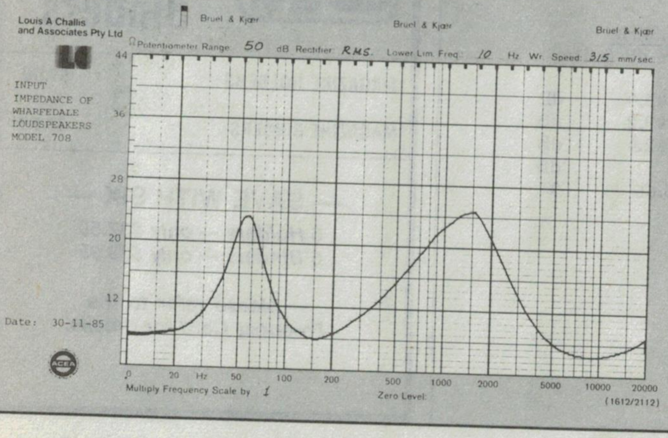

Louis A Challis and Associates Pty Ltd
Brüel & Kjær
FREQUENCY RESPONSE OF WHARFEDALE SPEAKERS MODEL 708
MEASURED AT 1M ON TWEETER AXIS
LINEAR FREQUENCY SCALE
Date: 30-11-85
QP 1102


Louis A Challis and Associates Pty Ltd
Brüel & Kjær
Potentiometer Range: 50 dB Rectifier: R.M.S. Lower Lim. Freq.: 20 Hz Wr. Speed: 3.15 mm/sec.
FREQUENCY RESPONSE OF WHARFEDALE LOUDSPEAKER MODEL 708
MEASURED AT 2M ON TWEETER AXIS
30-11-85
Multiply Frequency Scale by
Zero Level:


Louis A Challis and Associates Pty Ltd
Brüel & Kjær
Potentiometer Range: 50 dB Rectifier: R.M.S. Lower Lim. Freq.: 20 Hz Wr. Speed: 3.15 mm/sec
FREQUENCY RESPONSE OF WHARFEDALE LOUDSPEAKERS MODEL 708
MEASURED AT 2M 30° OFF TWEETER AXIS
Date: 30-11-85
Multiply Frequency Scale by 1
Zero Level:


Louis A Challis and Associates Pty Ltd
Brüel & Kjær
Potentiometer Range: 50 dB Rectifier: RMS. Lower Lim. Freq.: 20 Hz Wr. Speed: 3.15 mm/sec.
FREQUENCY RESPONSE OF WHARFEDALE LOUDSPEAKER MODEL 708
MEASURED AT 5CM FROM WOOFER AND TWEETER
Date: 30-11-85
Multiply Frequency Scale by
Zero Level:


Louis A Challis and Associates Pty Ltd
PHASE RESPONSE OF WHARFEDALE LOUDSPEAKER MODEL 708
MEASURED AT 2M ON TWEETER AXIS
Date: 30-11-85


Louis A Challis and Associates Pty Ltd
Brüel & Kjær
Potentiometer Range: 50 dB Rectifier: RMS. Lower Lim. Freq.: 10 Hz Wr. Speed: 3.15 mm/sec.
INPUT IMPEDANCE OF WHARFEDALE LOUDSPEAKERS MODEL 708
Date: 30-11-85
Multiply Frequency Scale by 1
Zero Level:

more marked than one would expect from a 'quality speaker' and most certainly far more prominent than those that I have observed from measurements on other Wharfedale speakers during the last five years.

The overall impression that I gained from the decay response spectra was that these speakers would exhibit a very coloured response and that many musical instruments and, probably, speech would sound unnatural.

The polar response of the Wharfedale 708 speakers at 1 kHz is 3 dB down at ±40°, which is considerably less than I would have expected; at 3 kHz it is 3 dB down at ±60°, which is somewhat better. At 6.3 kHz, the response exhibited an unusual degree of non-linearity with a petal shaped primary response on-axis; a softening of the tweeter coil became evident in the response of the first set of speakers. At 10 kHz, the polar response was far more uniform and rather surprisingly extended to approximately ±50°.

Taken overall, the objective performance characteristics of the Wharfedale 708 speakers was not as impressive as one might expect from the manufacturer's claims and not in keeping with a speaker system intended to sell at around $1500 per pair.

Subjective testing

The subjective performance evaluation revealed immediately that the low frequency response was very poor and even when mounted on the speaker stands still failed to provide an effective acoustic output below 100 Hz.

The first selection of programme content that I evaluated was a special live recording demonstration tape produced by the ABC from the Bob Hudson Show. I played this tape on a Nakamichi Dragon cassette player which provides a frequency response which is remarkably flat and better than ±2 dB from 20 Hz to 20 kHz. The quality and timbre of the voices was decidedly unnatural and highlighted the lack of spectral uniformity of the speakers. This particular voice test, using known speakers and with material recorded under studio conditions, is one of the most critical tests that can be applied to a speaker for it evaluates the frequency spectrum from 150 Hz to 6 kHz.

The second and third programme selections were based on an evaluation of two new CDs (Elton John's "Nikita" from "Ice On Fire" (Rocket 826 213-2) and Charles Dutoit in Franz von Suppé's "Light Cavalry" (Decca 414 408-2)). The audible colouration was pronounced and many sections of the straight orchestral music sounded flat and not particularly exciting. I found that some sections of the music, including violins, cellos, and even the harp, sounded realistic but with every piece I listened to I was more aware of the speakers than I was of the music.

In England, the Wharfedale 708s are marketed as technologically advanced speakers which are intended to out-perform other speakers in the same price range. In Australia, with a mooted selling price of approximately $1500 per pair, they do not appear to out-perform other speakers in their price range and the relation of the Australian price to the English price leads me to wonder what's happened to the Australian dollar. ●

MEASURED PERFORMANCE OF: WHARFEDALE 708 LOUDSPEAKERS

FREQUENCY RESPONSE: 90 Hz to 20 kHz

CROSSOVER FREQUENCIES: 2.2 kHz

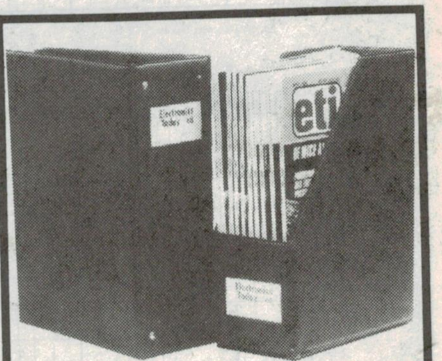
SENSITIVITY: (for 96 dB average at 1m) 11.5 V r.m.s. = 16.5 Watts (nominal into 8 Ohms)

HARMONIC DISTORTION: (for 96 dB at 1m)

	100Hz 90dB @ 1m	1kHz	6.3kHz 96 dB @ 1m	
2nd	33.3	-49.8	-45.0	dB
3rd	28.7	-59.9	-49.2	dB
4th	51.1	-	-62.4	dB
5th	60.9	-	-	dB
THD	4.3	0.34	0.66	%

INPUT IMPEDANCE ONE TEST: 100Hz/7kHz 4:1

100 Hz	8.8 ohms
1 kHz	22.5 ohms
6.3 kHz	7.2 ohms
Min at 4 kHz	6.4 ohms



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Intel's 386 family

The highest-performance general-purpose commercial microprocessor ever developed has been introduced by Intel Corp. The 80386 32-bit microprocessor along with a line of complimentary board and software products is expected to significantly expand the fledgling market for 32-bit microprocessor-based computers.

The 80386 chip is fully compatible with all software generated for Intel's iAPX 86 family, which includes the 8086, 8088, 80186, 80188 and 80286 processors.

The 80386 leads existing 32-bit microprocessors in a number of important areas. It operates at a sustained speed of 3 million to 4 million instructions per second (MIPS), which is substantially higher than the nearest competitor. The 80386 contains on-chip support for the greatest 'virtual' memory addressability, more than 64 trillion bytes of information. As well, the chip provides a 'multiple-execution' environment that allows it to simultaneously run programs written for different operating systems, such as Unix and MS-DOS operating systems.

The 386 family of single-board computers (SBCs) takes advantage of the enormous base of existing hardware through the new iSBC 386/20 80386-based single-board computer. This is possible because the iSBC 386/20 board is based on Intel's Multibus I system bus architecture, which has been adopted as standard (IEEE 796) by the Institute of Electrical and Electronics Engineers. The iSBC 386/20 is therefore fully compatible with the largest hardware base available to any 32-bit microprocessor.

Included in the 386 family are the iSBC 386/20 Multibus I board, the iSBC 386/100 Multibus II board, 386 operating systems and 386 development software. Together with the new microprocessor, these products provide for a range of new applications: multiuser microcomputers that pack all the performance of today's minicomputers; advanced robots; machine vision and voice recognition systems; advanced PBXs (private branch exhanges); and sophisticated workstations that bring complementary disciplines together, such as engineering design automation and office automation, or manufacturing information systems and factory control.

The 80386 is designed using Intel's CHMOS-III (complementary high-performance metal-oxide semiconductor) 1.5-micron process, which combines high performance with low power consumption and small transistor size. CHMOS allows the 80386 to reach the highest integration ever achieved on a commercial logic chip (more than 275,000 transistors) and clock speeds of 12 MHz and 16 MHz.

The 80386 features on-chip self-testing, debugging and memory management (which allows fast multitasking and multiple execution environments), as well as software protection, a requirement for reliable multitasking and high-security systems. The microprocessor supports both segmentation and paging memory-management techniques.

The 80386 can also take advantage of co-processors developed for use with Intel's 8086 and 80286 microprocessors. The 80287 numerics co-processor, for example, accelerates a range of mathematical functions in applictions such as industrial control, engineering processing and financial processing. Other available co-processors include the 82258 input/output co-processor, which off-loads input and output tasks that can slow the central processor, and the 82586 and 82588 local area network co-processors, which provide for an easy implementation of computer communications networks.

For further information contact **Intel Aust, Level 6, 200 Pacific Hwy, Crows Nest, NSW 2065. (02)957-2744.**

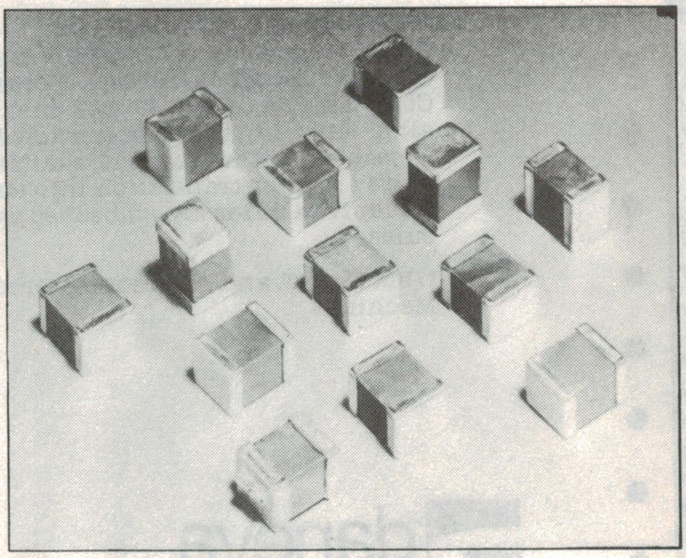
Surface mounting aluminium electrolytics

Philips has announced the world's first solid aluminium electrolytic capacitors for surface mounting, the 126 series.

The caps are said to be suitable for all current soldering methods. They offer electrical and mechanical robustness, and long lifetimes because they avoid failure mechanisms such as drying-out or shorting. Other features are a high allowable reverse current of up to 80%, and no requirement for charge/discharge limiting resistors.

The 126 capacitors are SMD versions of the established 122 series; all electrical parameters are identical. Five case sizes are available with widths and heights of 4 x 2.5, 5 x 3, 5 x 4, 7.5 x 4 and 7.5 x 5 mm; the length is 6.5 mm in each instance. This length allows the capacitors to be used on existing pcbs designed for 5 mm leaded components in mixed print formats, thereby facilitating the transition from conventional mounting methods to SMD.

Specs are: a temperature range without derating of −55 to 125°C; possible temperature range with derating of −55 to 175°C. Under endurance test conditions, lifetimes at 85°C and 125°C are 5000 and 2000 hours respectively. Resistance to soldering heat is specified as 10 seconds at 260°C, however, the construction of the capacitors could allow for longer specified times in the future. Complete immersion in solder is permitted.



Nominal capacitance ranges from 0.1 to 68 μF, tolerance on nominal capacitance is ±20% but ±10% is available on special request. Rated voltage range is 6.3 to 40 V.

For further information contact **Philips Electronic Components & Materials, 11 Waltham St, Artarmon, NSW 2064. (02)439-3322.**

BRIEFS

Lab standard condenser mic

In response to growing demands for a high stability, laboratory standard half-inch microphone, Brüel & Kjaer has introduced the Type 4180. It has a frequency response which is flat (±1, 5 dB) up to 20 kHz and it can be used for measurements up to 40 kHz. The Type 4180 will find applications in coupler measurements and in pressure and free-field reciprocity calibrations. For more information contact B&K at 33 Majors Bay Rd, Concord, NSW 2137. (02)736-1755.

Dynamic memory

Texas Instruments has begun volume production of its 256K x 1 dynamic random access memory. It's available in two versions, the TMS4256 page-mode device, and the TMS4257 nibble mode device, offering designers flexibility in system design. The 256K DRAM is directly upward compatible with TI's 64K DRAM, allowing an immediate quadrupling of system memory capacity without redesign or additional hardware. More information is available from TI at 6-10 Talavera Rd, North Ryde, NSW 2113. (02)887-1122.

NEC fibres

NEC Australia Pty Ltd has signed a distribution agreement with Data Cable establishing it as the Australian distributor for NEC's complete range of fibre optic components, semiconductor optical devices and gas lasers. For more information contact Data Cable, 538 Mountain Hwy, Bayswater, Vic 3153. (03)729-0044.

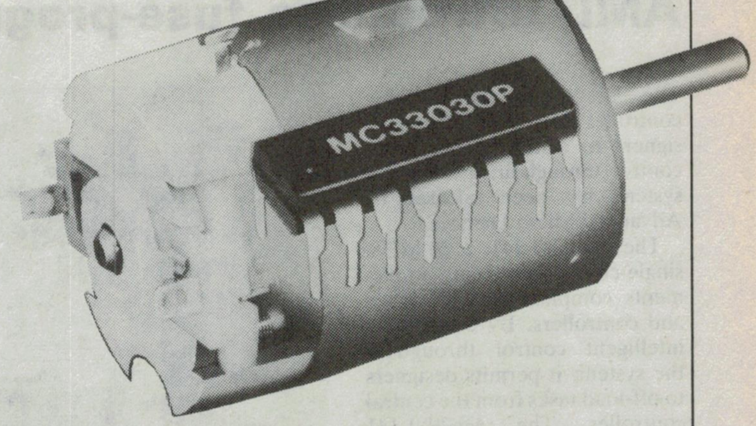
FSK modem

The EF7910 is a single-chip asynchronous frequency shift keying voiceband modem. It is pin selectable for baud rates of 300, 600 or 1200 bps and is compatible with the applicable Bell and CCITT recommended standards for 103/115 108, 202, V.21 and V.23 type modems. Five mode control lines select a desired modem configuration. They are available from Promark Electronics, PO Box 381, Crows Nest, NSW 2065.

TI ROM

The new TMS2364 64K ROM from Texas Instruments offers a fast 150 ns maximum access time along with the 28-pin industry standard package and is designed to complement TI's other 64K ROM, the TMS4764 24-pin package. This new ROM is designed as an alternative to EPROMs in high-volume applications such as automotive, and industrial controls, printers, personal computers and telecommunications equipment. It is designed to provide fast turnaround typically within an eight week lead time.

For further information contact Texas Instruments, 6-10 Talavera Rd, North Ryde, NSW 2065. (02)887-1122.



New dc servo motor controller

The Motorola MC33030 is a new monolithic dc servo motor controller-driver that contains all the active functions necessary for a complete closed loop system. It is ideally suited for bidirectional drive of fractional horsepower motors in applications where precise position sensing is required.

The MC33030 contains an error amplifier and window detector, both of which feature a wide input common-mode voltage range and a self-centring reference; drive and brake logic with direction memory, as well as an independently programmable over-current detector, over-current and over voltage shut-down delay. Motorola can be contacted on (02)438-1955.

Microswitches

A reliable low-profile microswitch for pcb mounting, available in single- and double-pole versions, has been released in Australia. The LPSP single-pole and LPDP double-pole switches are under 8 mm high and measure 19 x 7 mm and 19 x 14 mm, respectively. Both are capable of switching voltages up to 250 Vac or dc, and life is in excess of 10^7 cycles. For more information contact Email Ltd Relays Division, 15 Hume St, Huntingdale, Vic 3166.

Depletion transistor

Siemens has developed a new small-signal transistor for threshold voltages of negative value. The n-channel SIPMOS BSS 129 transistor, in a TO-92 plastic package, has a typical threshold voltage of 1 V. A maximum drain-source switch-on resistance of 20 ohms results from an 0 V gate source voltage and a drain current of 14 mA. For more information contact Siemens, 544 Church St, Richmond, Vic 3121. (03)429-7111.

IR LED/phototransistor pair

The OP293/OP298 is a gallium-aluminium-arsenide infrared LED, spectrally matched to the OP593/598 GaAlAs phototransistor. The OP293 diode has a broad emission angle, while the OP298 diode has a narrow angle. Used in a touch screen application, the CRT is framed with a row of LEDs along its left edge and a corresponding row of phototransistors along its right edge. The horizontal light beam emitted from any LED is sensed by the corresponding phototransistor and by no other. Similarly there is a row of LEDs along the bottom edge. The unit-to-unit spacing in any row is around 0.25 to 0.5 inch.

For further information, please contact Total Electronics, 9 Harker St, Burwood, Vic 3125. (03)288-4044.

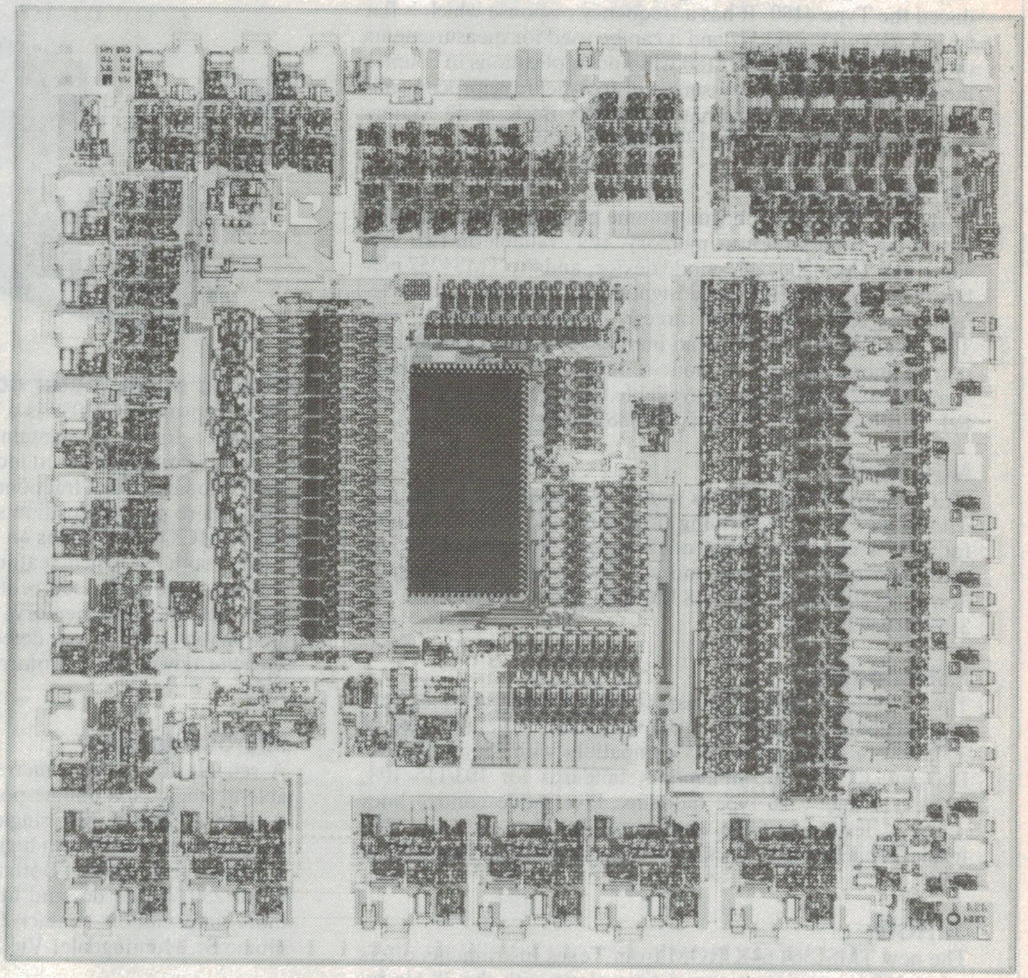
CMOS static RAM module

National Semiconductor has introduced a 16K x 8-bit CMOS static RAM module, the MA2017L, featuring a replaceable lithium battery as its power supply backup.

The module is a 63.5 x 40.6 x 8.89 mm dual-in-package and includes the address decoder and the voltage comparator circuitry. It can decode up to 128K x 8-bits. Multiple MA2017L modules may be stacked in piggyback fashion, carrying the bus upward or, it can be soldered to a printed circuit board, like conventional DIPs.

For more information contact **National Semiconductor, 21/3 High St, Bayswater, Vic 3153. (03)729-6333.**

AMD introduces fuse-programmable controller



The first fuse-programmable controller chip, which allows designers to distribute intelligent control throughout a computer system, has been released by Advanced Micro Devices.

The Am29PL141, a 20 MHz, single-chip component, implements complex state machines and controllers. By distributing intelligent control throughout the system, it permits designers to off-load tasks from the central controller. The Am29PL141 consists of a sequencer, a 64-word x 32-bit PROM, and a 32-bit output register.

The Am29PL141 off-loads the central controller by allowing distribution of fuse-programmable controllers throughout the system. These serve as the control for self-contained functional units such as register file, ALU, I/O, interrupt, diagnostic, and bus control. It contains AMD's Serial Shadow Register on-chip diagnostics that use serial-scan techniques to pinpoint system malfunctions at the board or component level.

The 28-pin, two-watt device functionally replaces 8.5 packages that have a total of 180 pins and use 6.5 watts.

Programming support for the Am29PL141 is via the Data I/O System 29 or Valley Data Series 160. To support software, AMD has developed an assembler, and is developing a software simulator, which will be in the public domain.

For more information contact **R&D Electronics, 4 Florence St, Burwood, Vic, 3125. (03)288-8911.**

New CMOS logic family

A new family of advanced CMOS logic circuits that exceeds the performance of standard and advanced low-power Schottky as well as existing HCMOS devices has been introduced by Fairchild Camera and Instrument Corporation.

Called FACT (Fairchild Advanced CMOS Technology), the devices draw three orders of magnitude less power than equivalent Schottky TTL devices, according to Ray Becker, strategic marketing manager for Fairchild's Digital Products Division.

Power consumption is as low as 0.1 milliwatt per gate at 1 MHz clock frequency, with propagation delays of just five ns. Devices will include more than 80 of the widely used industry-standard 54 and 74 series logic circuits.

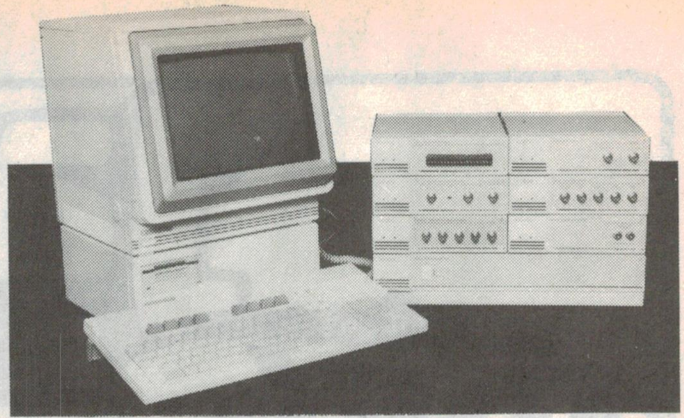
The 74AC-Series devices are capable of driving 50 ohm and the 54 AC Series 75 ohm transmission lines. This makes the family ideally suited to bus-driven systems, according to Becker, and is a first for CMOS logic circuits.

"Switching speed of the FACT line is almost twice that achieved by the CMOS processes of other manufacturers, Becker said. "High speed is largely due to the fine geometry of the Fairchild process that produces gate lengths of 1.25 micrometres. The metallisation process reduces die size and interconnection capacitances which minimises waveform distortion and crosstalk, and improves reliability."

Devices immediately available in sample quantities include 54AC/74AC74 D-type positive edge-triggered flipflops, 54AC/74AC240 and 54ACT/74ACT244 octal buffers/line drivers with 3-state outputs, and 54AC/74AC373 octal transparent latches with 3-state outputs. These devices can be ordered in dual-in-line packages (DIL), small outline integrated circuit packages (SOIC), flatpack, leadless chip carrier (LCC) and plastic chip carrier (PCC) packages.

For more information contact **Fairchild Aust, 366 Whitehorse Rd, Nunawading, Vic 3131. (03)877-5444.**

Instrumenting the PC



The HP PC Instrument System linked to the HP-150 computer.

With growing clouds obscuring the outlook for the personal computer market, there is at least one corner of it that seems to be continuing its rapid growth.

According to a new market research report from International Resource Development (IRD), the market for analogue input subsystems which convert a personal computer into a personal instrument is continuing to grow fast. The key to the rapid growth of this market has been the development of software packages which offer integration of set-up, data acquisition and analysis and display.

Typically such systems record data from scientific experiments, industrial research and design, and medical analysis. They can be used to analyse results, often in loop fashion so as to modify experimentation, adjusting controls when necessary.

The size of the personal instrument market, about $US700 million this year, is likely to reach the $US1 billion level in 1986 and to double to $US2 billion by 1990. On average, according to the IRD report, about half of this shipment value is accounted for by the computers; the remainder is made up of instruments, interfaces and software.

Within the last few years the techniques of integrated circuit fabrication have been applied to the creation of micromechanical devices such as single chip pressure sensors and wafer scale gas chromatography channels. The ability to cut features as small as one micron wide, together with the physical and electrical properties of crystalline silicon and other materials, make it possible to reduce a wide variety of sensing devices to individual chips, and to integrate analogue and digital control and interface circuitry on chip. Precursors of the fully integrated single chip sensor will be hybrid devices in which micromechanical and integrated circuit chips will be packaged together in a single DIP, as hybrid analogue/digital electronic circuits are already.

The next step will be the building of integrated devices incorporating several sensors and all of the necessary circuitry on a chip together with devices such as lasers for providing the experimental stimulus. According to the IRD study the possible applications of integrated instrumentation technology have yet, in many cases, to be invented.

The general purpose instrument bus (GPIB) espoused by Hewlett-Packard and others, is the interface of choice for combining off-the-shelf instruments with a variety of computers. The IRD researchers expect that the increasing variety of low-cost, high-powered instruments, together with use of single-chip GPIB controllers, will increase the dominance of GPIB. There are, says the IRD report, some 2000 instruments now available on the market with GPIB interfaces.

More than one hundred companies are active as suppliers of computers, instruments, interfaces or software. To the surprise of no one, IBM is named as the principal supplier of computers used in personal instrument systems. Through its IBM Instruments subsidiary, IBM is also expected to be increasingly aggressive in the development of instruments, interfaces and software.

However, IBM has a long way to go before there is a real challenge to Hewlett-Packard's across-the-board leadership in the instrumentation end. It's not necessary for the smaller suppliers to get caught in the crossfire between HP and IBM. This market is particularly well-supplied with specialty niche opportunities for small companies.

RCL meter

Philips has recently released a fully automatic, high accuracy RCL meter to take the pain out of capacitor and inductor measurements. The PM 6303 boasts a microprocessor controlled test sequence which is able to determine the dominant element (capacitance, resistance or inductance) in an unknown component and display its value and equivalent circuit on an LCD display screen.

Traditional measurement techniques generally make use of some kind of manually adjusted null-meter technique using bridge type circuitry. The main drawback of such an instrument is that accurate results can require some fiddly and time-consuming adjustments to the meter controls. The PM 6303 exploits the power of the micro to implement a comprehensive voltage/current measurement technique which allows the user to get a readout with an accuracy of 0.25% in 0.5 seconds, it is claimed.

The micro also controls the on-screen graphics which display an equivalent circuit of the component under test (CUT). An 'RCL Auto' range is provided which allows the user to insert a completely unknown component and the meter will determine its dominant characteristic and measure it. The meter will also determine whether a reactive component should be modelled with a series or parallel resistance and display the equivalent circuit on the screen.

For more information contact **your local Philips dealer.**

BRIEFS

Microwave training system

Terco's System TR 2300, developed in conjunction with the University of Technology in Sweden, offers a wide range of training applications. It can perform experiments like steady wave amplitude ratio measurements, steady wave in a waveguide with and without central conductor, antenna measurement in which the antenna is used as a matching device between a line and open space and doppler experiments using a directional coupler and doppler radar. For more information contact Electrical Equipment Ltd, Unit C, 8 Lyon Park Rd, North Ryde, NSW 2113.

Security dialler

Dick Smith Electronics has introduced a security system which automatically dials a central security office 'Voice Call' when activated. Authorities at Voice Call may call the police, your security service or yourself at work. The system can also be linked to your pocket pager and a series of beeps or tones will alert you instantly. The fee for this type of monitoring is from $4 per week; the cost of the dialler is $249.

Off-line switchers

The 50F Series of 50 W triple and quad output off-line switchers is now available. Each model in this series features a 32 ms hold-up time at nominal line and full load, allowing a greater amount of the critical time needed to save data and ride through momentary power 'outages'. For further information, contact The George Brown Electronics Group, 174 Parramatta Rd, Camperdown, NSW 2050. (02) 519-5855.

400 W dual output

The JPS-3 dual output lab power supply offers up to 200 W simultaneously from 0 V to 40 V, from each of its two outputs. Thus it can be operated as single power supply, delivering up to 400 W continuously, fully adjustable from 0 V to 80 V. It works at any ambient temperature in its operating range for limited periods or at slightly reduced ambient temperatures. Design of the JPS-3 is for up to 500 W to be delivered with the same overall performance characteristics. For more information contact Jacobs Radio, 4 Clare St, Bayswater, Vic 3153.

Catalogue

Tech Rentals has just released its rental catalogue. The catalogue is the largest yet and contains an improved range of test, measurement and computer equipment. It also includes, for the first time, a sale listing of ex-rental equipment. Tech-Rentals Pty Ltd is at 12 Maroondah Hwy, Ringwood, Vic 3134. (03)879-2266.

Two Tektronix CROs

Two portable digital storage oscilloscopes have been released by Tektronix. The 2230 offers 100 MHz equivalent time storage bandwidth; the 2220 offers a 60 MHz storage bandwidth. Both double as dual channel analogue oscilloscopes. They use a 20 m sample/s, 8-bit, two-step parallel digitiser. The sampler runs at 10 MHz on even the slowest sweep speeds.

IEEE-488 bus analyser/monitor

National Instruments has released the GPIB-410, an IEEE-488 bus analyser. This new product consists of an interface card and software that converts an IBM-PC or compatible into an IEEE-488 bus analyser.

The product is designed for GPIB (also known as HP-IB and IEEE-488), troubleshooting and analysis applications, such as designing and debugging a network of test and measurement equipment controlled by a general-purpose computer. Using the GPIB-410, the operator can capture large blocks of data in the analyser memory as the network exchanges signals and data. Intermittent problems, such as a GPIB bus hangup can be analysed by scrolling through the captured data, which is a complete record of the events that led to the hangup.

The analyser can also be used in low-level operations to manipulate and monitor individual bus signals, or in high-level operations where it can run without operator intervention as it captures and stores data for later analysis.

Product hardware consists of a single full-size circuit board, the standard IEEE-488 bus connector, and a BNC connector that handles trigger inputs and outputs.

The GPIB-410 software offers a range of functions or modes, including emulation. The PC monitor emulates a control panel that indicates GPIB line states. The emulated control panel is complete with simulated switches that can be toggled by keyboard entries. Users can assert signal lines and alter data lines by keyboard entries. Data is represented in both ASCII and hexadecimal forms.

The software also provides a pattern-generating mode called 'Auto-Talker', which allows the user to interactively place data and control-line patterns on the GPIB in various sequences that simulate actual operating conditions. The patterns can be stored in a file, and then loaded from the file into the GPIB at full bus speed.

For further information contact **Elmeasco, PO Box 30, Concord, NSW 2137. (02)736-2888.**

Video generator

The first in a new family of component analogue video products is being launched by Tektronix.

The TSG-300 Component Television Generator will provide direct digital test signal generation in a wide range of formats. Proposed applications range from research and development to routine maintenance of more component-based ENG equipment.

Signals include colour bars, linearity, pulse and bar, and multiburst, as well as new component test signals.

The generator accommodates a number of component formats, including RGB, YUV (EBU or Betacam), YIQ (M Format) and Y, CTDM. It uses 10-bit digital signal generation at 13.5 MHz and can be used in either 525/60 or 625/50 systems.

For further information contact **Tektronix, 80 Waterloo Rd, North Ryde, NSW 2113. (02)888-7066.**

Fibre optic power meter

Data Cable has introduced a new low-cost, hand-held fibre optic power meter manufactured by Fotec. It's called the M200 and is designed for testing computer and process control data communications links.

Using a silicon photodetector for greater sensitivity with typical 820 nM LED sources, the M200 offers both dB and watts ranges. It uses an autoranging preamplifier which provides a readout in watts and there is a dB converter that offers very good accuracy. The dynamic range of the instrument covers +3 to −60 dBm and 2 mW to 10 nW.

Readings are displayed on a large 18 mm liquid crystal display with annunciators showing the range selected. To simplify operation further, only one control is provided — a switch for power and dB or watts selection.

The M200 is designed for troubleshooting computer datalinks, since its dB ranges make cable loss measurements easy and the watts ranges allow simple monitoring of source and received power.

For more information contact **Data Cable, 538 Mountain Hwy, Bayswater, Vic 3153. (03)729-0044.**

Mice 32 in-circuit emulator

Microtek has announced the release of the newest Mice generation. The Mice-32 is designed as a complete development station, with a powerful new in-circuit emulator and all the software tools required for fully integrated system development.

The Mice-32 incorporates advanced hardware and software technology that permits an ordinary IBM PC/XT/AT or compatible system to be used for program development/debug, emulation/tracing, symbolic debug, logic state analysis and software performance analysis.

The menu mode features user-friendly softkey operation, with commands arranged in a tree structure. Other features are on-line editing with command parameters retained from previous specification; symbolic debug utilities; logic state analysis which displays signal waveform (up to 16 channels) for any of 104 trace points, including up to eight hardware trace points; and software performance analysis for module entry, module duration and execution interval analysis.

The command mode input method is compatible with Mice-II, and provides the command base required for batch files, as well as log file utility for recording entire debug session, and on-line assembly and disassembly.

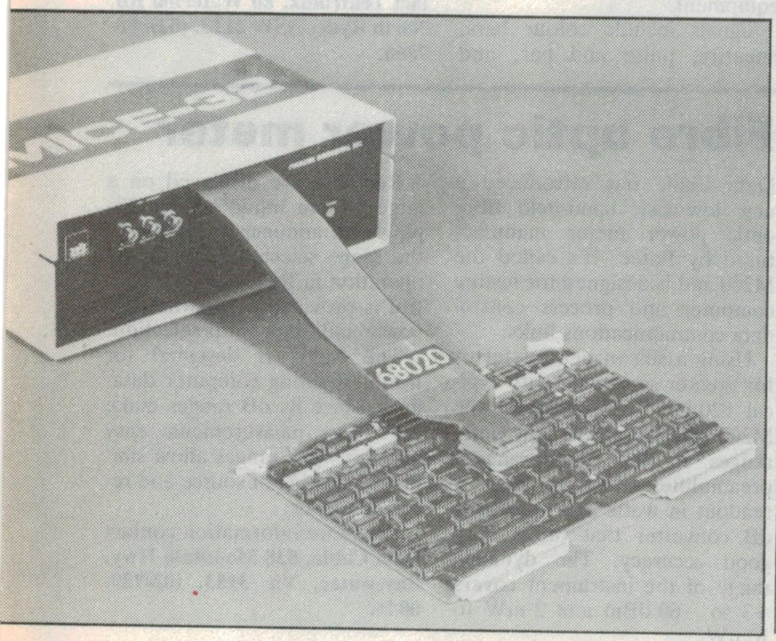
The Mice-32 boasts fast memory manipulation commands (for examine, fill, search, compare, move, checksum and test); fast file transfer utilities; disable/enable control signals for bus error, bus request, interrupt and cache; disassembly, symbolic debug, cycle-step and instruction-step assist hardware/software debug; register display/modification, including display of flag status; and dynamic bus sizing. All settings are software programmable (eg memory map, clock select, DSACK, etc).

The real time trace is supported whenever the processor is running.

The trace buffer is 2048 cycles deep and 104 cycles wide (32-bit address, 32-bit data, 8-bit status, 8-bit external trace points and 24-bit timer).

Execution time for each cycle can be displayed at a resolution of 1 μs~10 ms (max effective duration depends on selection).

For further information contact **Macro Dynamics, 80 Lewis Rd, Wantirna Sth, Vic, 3152. (03)220-7260.**



Low cost microprocessor development system

The HDS-300 is a low-cost microprocessor/microcontroller hardware development station providing real-time hardware/software emulation support for the MC68HC11 microcomputer and the MC6809 and M6801 microprocessor families.

The HDS-300 is a stand-alone development system that requires only the target object file from the host system. Almost any terminal with a standard RS232C port can be used with the HDS-300. Emulator modules are used to interface the HDS-300 to a variety of microprocessors.

The HDS-300 consists of a control station with a built-in 5¼″ disk drive for program execution to the target processor, user target code, user macros, and terminal configuration data. It also features a real-time signal-tracing bus state monitor and a built-in assembler/disassembler for the target processor.

The HDS-300 allows software and hardware to be developed and tested at an early stage of the development process, permitting hardware configuration and software code changes to be made while still at the prototyping stage.

Original algorithms and I/O parameters can be tested before the final software code is written. After this stage is completed, a source program is prepared by using the host's editing facilities.

For development support on the MC68HC11, the MC68HC11 Cross C compiler provides high-level language for product development.

For further information contact **Motorola, on (02)438-1955.**

CMOS single card computer

The JED-STD/800 CPU card is designed to provide system developers with a CPU card usable either as a single card computer or as the main computing element in a multi-card system made up of a number of STD bus cards in a rack.

This Australian designed and manufactured computer is intended for a range of applications: its low power consumption (approximately 0.5 watt from a 5 volt supply) makes it appropriate in field data logging applications, as well as in industrial, commercial and educational applications.

The card includes parallel and serial (RS232) I/O, eight analogue inputs (8 or 10 bits), a real time clock, EEPROM, RAM, PROM, two 16-bit counters and full STD bus interfacing.

For program development, simply connect a terminal (or the new JED video board) and type in a BASIC program. When it all works, the JED PROM programmer plugs into the top end of the board, the program transfers into PROM, and the PROM(s) plugs into the USER sockets. Machine code debugging is easy with the single step monitor command, and programs assembled on a CP/M system are passed across as hex files.

The card uses the National Semiconductor CMOS NSC800 CPU, running at a 4 MHz clock rate, along with a number of other CMOS LSI peripheral chips, memory devices and STD bus support.

This CMOS CPU emulates the Zilog Z80 CPU instruction set. Thus, all Z80 software, operating systems, compilers, etc work in exactly the same way, and instruction timing (for an equivalent internal clock frequency) is identical (except that a wait state is automatically inserted into input and output instructions).

For further information contact **JED, 28 Anderson St, Boronia, Vic 3155. (03)762-3588.**

COMPUTER AIDED ELECTRONICS DESIGN

Hewlett-Packard makes its bid

Using computers to help electronics designers design electronics is becoming an everyday event. Hewlett-Packard, a company with quite a bit of success in instrumentation and computers, thinks it can become the world's largest supplier of electronics computer aided design equipment.

David Kelly

IT IS NOT uncommon to hear of a piece of domestic or industrial electronics equipment that took 100,000 or even a million person-hours to develop. When you think of the design time involved in each IC and add some microcomputer software to the final product it's easy to see where the time goes.

This high design cost is the reason many electronic products enter the market at very high prices only to become considerably cheaper once the manufacturer has recovered the development cost. Ironically, it is the countries like Japan and the United States with the highest engineering and design costs that to date have been the most successful designers of electronic products.

But the fear in these countries is that one day these high design costs could bring an end to their success as electronics manufacturers. So it's not hard to see why computer aided electronics design products, intended to increase the productivity of electronics designers, have attracted so much research and development over the last few years.

Hewlett-Packard

The US electronics company, Hewlett-Packard, has established a Design Systems Group with several hardware and nearly a thousand software products for computer aided design. Recently HP opened a Design Systems Group support centre in Hong Kong to help it install computer aided design systems in Asia and Australia. HP will be able to rest on its laurels when it approaches electronics designers looking for CAD systems. It started its career as an electronics instrument maker 45 years ago with a 1% distortion audio oscillator. The company's reputation and the performance of its instruments have improved steadily ever since.

In the 70s HP surprised the electronics community with a range of general purpose mini computers. Although not as profitably, the company's computers now outsell its test and measuring instruments. Computer aided pc board test equipment, microprocessor development systems and some CAD systems followed in the 80s. Like many computer products HP knows it will have to sell its design hardware along with a bundle of mostly off-the-shelf software. Sometimes special design software will need to be written by HP, a third party software house or as a joint venture with the customer.

In Taiwan HP and Formosa Plastics have completed such a joint venture. The result is special board design software which will be sold around the world by HP.

Hewlett-Packard will be looking to companies in Australia to help it design software as a joint venture or to write software as a third party supplier.

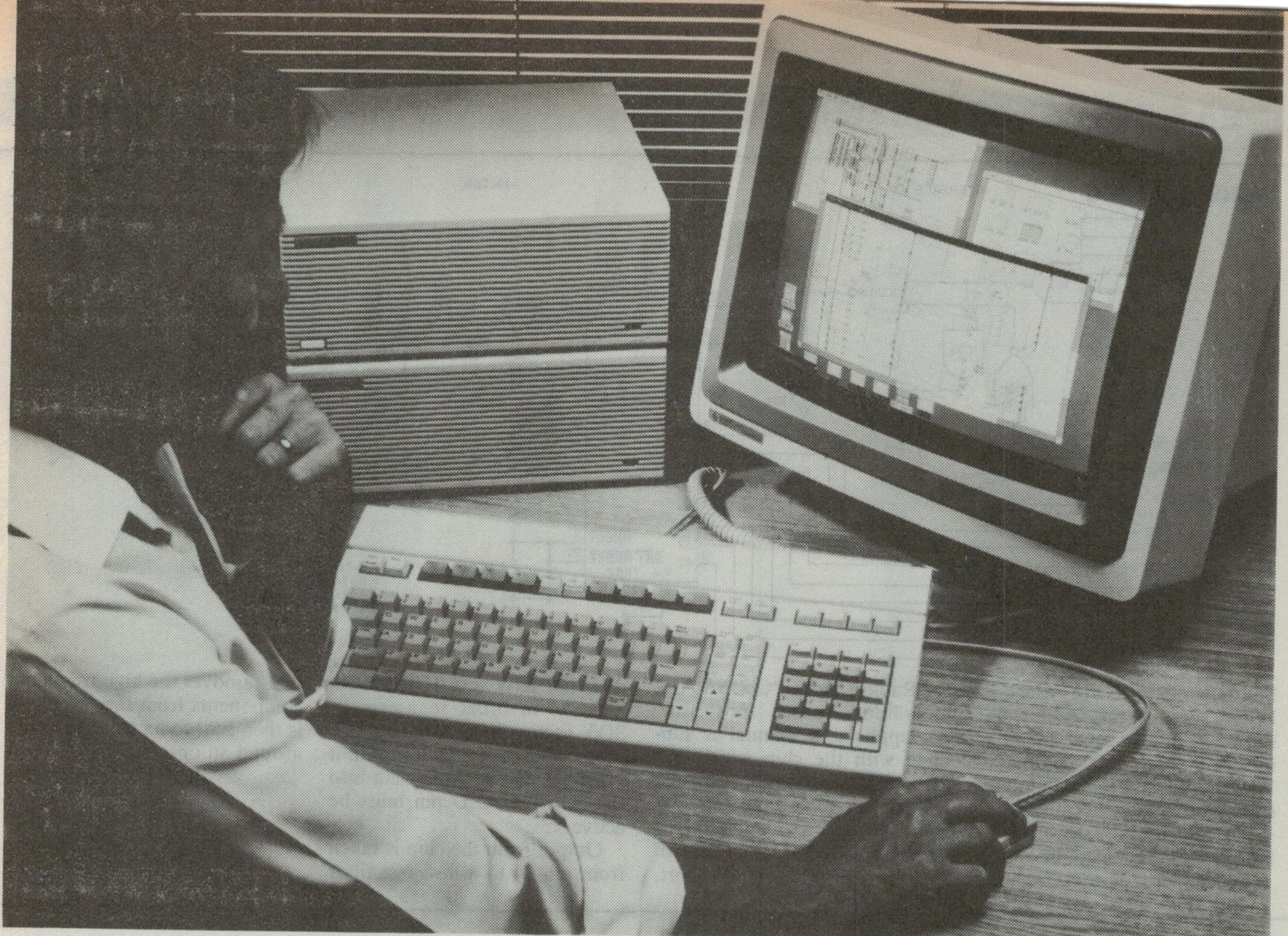
CAD systems

It seems that in every new application the first generation of computer products is designed more to accommodate the limitations of computers than to be totally 'friendly' in the new application. Certainly this is true of electronics CAD. Even now the vast majority of electronics CAD products is intended for digital rather than analogue design tasks. This is because the more black and white world of digital design generation and verification better suits the way CAD systems work. For the same reasons there were, among the early CAD systems, many products for the design of integrated circuits even though there weren't many people working in this area. According to Dick Watts, who is in charge of marketing the CAD systems worldwide, the rapid growth in the CAD market in 1983 and 1984 has started to taper off. Watts believes this is because of the limited 'friendliness' of the early generation systems and their tendency to concentrate on esoteric applications like IC design.

As you would expect Watts says that HP now has these problems licked with a range of products aimed mainly at board level design in small to medium sized electronics companies. Certainly the company seems to have aimed at a very practical level of design, concentrating more on design generation and verification than on fancy routines like automatic routing.

New hardware

At the opening of its new Hong Kong support centre Hewlett-Packard announced two CAD workstations, the HP Logic Design-station and the HP Personal Logic Design-station. The Logic Design-station uses workstations from the HP9000 300 series to run a Unix version operating system and a range of software including the GenRad Hilo-3 design verification packages. The personal version of the Logic Design-station is based on either HP's new Vectra personal computer or the similar IBM PC-AT.



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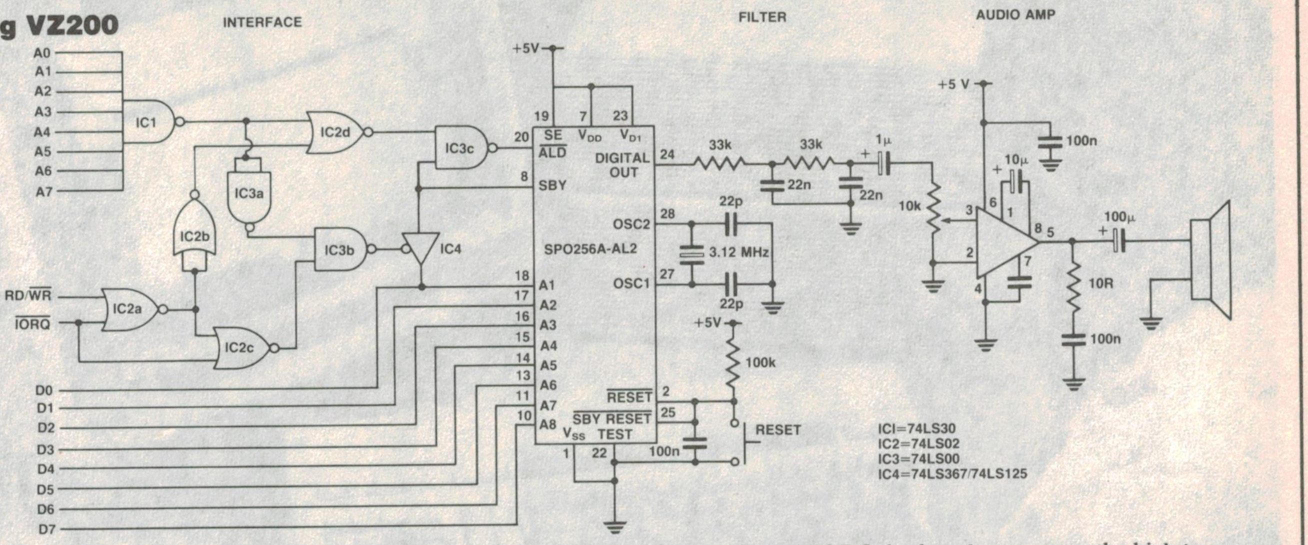
IDEAS FOR EXPERIMENTERS

Talking VZ200



Matthew Bennets of **Corowa NSW,** sent us this circuit designed to allow speech processing from the VZ200 computer. You could adapt the idea to any computer where you can control seven address and seven data lines, plus two control lines.

Centrepiece of the circuit is the Radio Shack SPO 256A AL2 monolithic speech processor. An application manual is supplied with the chip which will give full details of addressing the words available on the chip. Mr Bennets has provided interface circuitry such that an address of FFH is required on the port, with the R/W and IORQ both logic '0' in order to access it. SDY (active low) is only active when speech is being output from pin 24. To input data into the chip the ALD pin must be active.

Output from the chip is taken from pin 24 to a low pass filter that removes the high frequency components from the output. It is then sent to an amplifier built around an op-amp.

'IDEA OF THE MONTH' CONTEST

Scope Laboratories, which manufactures and distributes soldering irons and accessory tools, is sponsoring this contest with a prize given away every month for the best item submitted for publication in the 'Ideas for Experimenters' column — one of the most consistently popular features in ETI Magazine. Each month we will be giving away a 60 W Portable Cordless Soldering Iron, a 240 Volt Charging Adaptor together with a Holder Bracket. The prize is worth approx. $100.

Selections will be made at the sole discretion of the editorial staff of ETI Magazine. Apart from the prize, each person will be paid $20 for an item published. You must submit original ideas of circuits which have not previously been published. You may send as many entries as you wish.

COUPON

Cut and send to: **Scope/ETI 'Idea of the Month' Contest, ETI Magazine, P.O. Box 227, Waterloo NSW 2017.**

"I agree to the above terms and grant *Electronics Today International* all rights to publish my idea in ETI Magazine or other publications produced by it. I declare that the attached idea is my own original material, that it has not previously been published and that its publication does not violate any other copyright."

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Title of Idea ....

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RULES

This contest is open to all persons normally resident in Australia, with the exception of members of the staff of Scope Laboratories, The Federal Publishing Company Pty Limited, ESN, The Litho Centre and/or associated companies.

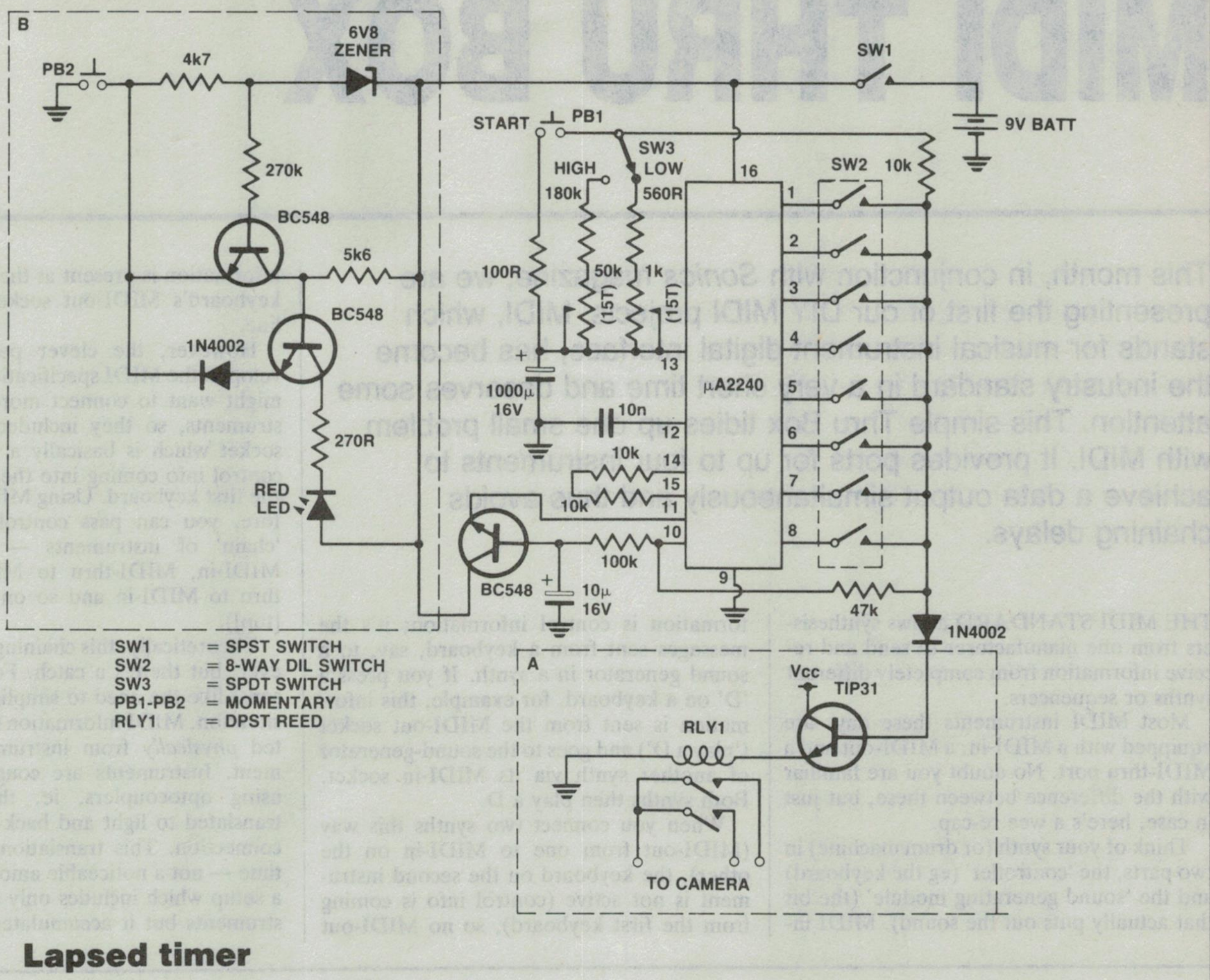
Closing date for each issue is the last day of the month. Entries received within seven days of that date will be accepted if postmarked to and including the date of the last day of the month.

The winning entry will be judged by the editor of ETI Magazine, whose decision will be final. No correspondence can be entered into regarding the decision.

The winner will be advised by telegram the same day the result is declared. The name of the winner, together with the winning idea, will be published in the next possible issue of ETI Magazine.

Contestants must enter their names and addresses where indicated on each entry form. Photostats or clearly written copies will be accepted but if sending copies you must cut out and include with each entry the month and page number from the bottom of the page of the contest. In other words, you can send in multiple entries but you will need extra copies of the magazine so that you send an original page number with each entry.

This contest is invalid in states where local laws prohibit entries. Entrants must sign the declaration on the coupon that they have read the above rules and agree to abide by their conditions.



Lapsed timer

Lewis Dixon,
Alstonville, NSW 2477

Some years ago Konica introduced the SF1, the first SLR camera with a built-in auto-wind. Now most manufacturers are producing auto-wind models in their SLR ranges.

These cameras lend themselves to be used for lapsed time photography, however, commercial lapsed timers are very expensive.

With this in mind a simple, relatively inexpensive lapsed timer was devised around a µA2240 programmable timer counter.

The external resistors and capacitor at pin 13 use 15 turn variable resistors for fine adjustment. Low gives 1 second at output 1. High gives 4 minutes. The binary output is wired to provide a wired-or function. The combined output will be low as long as any one of the outputs is low.

When switched to low, one can have exposures from 1 second to 4 minutes 15 seconds, at 1 second intervals; when set to high, 4 minutes to 17 hours in 4 minute intervals.

The µA2240 is used in its monostable application and is started by pressing the start button, SW2, switching on SW1 and immediately releasing SW2. This will allow the camera to fire once only and to start the IC counting (output low). At the end of the selected time the camera will fire again as the output goes high, putting a high on the reset pin 10 while the trigger pin 11 is momentarily held low by R9, C3 and Q3. The camera will therefore repeatedly fire at the fixed interval until switched off.

Section A is the camera firing mechanism for a Konica camera, the double reed switch being most convenient. Other cameras may require other types of relays depending on whether three or two leads are used. Power to fire the camera is supplied by the camera's own batteries, and only the connection of two, three or four leads is required to make an exposure.

Power for the circuit is from a 9 V 216 battery; section B is a simple battery tester. The cost is approximately $30.

MIDI THRU BOX

This month, in conjunction with *Sonics* magazine, we are presenting the first of our DIY MIDI projects. MIDI, which stands for musical instrument digital interface, has become the industry standard in a very short time and deserves some attention. This simple Thru Box tidies up one small problem with MIDI. It provides ports for up to four instruments to achieve a data output simultaneously and thus avoids chaining delays.

THE MIDI STANDARD allows synthesisers from one manufacturer to send and receive information from completely different synths or sequencers.

Most MIDI instruments these days are equipped with a MIDI-in, a MIDI-out and a MIDI-thru port. No doubt you are familiar with the difference between these, but just in case, here's a wee re-cap.

Think of your synth (or drum machine) in two parts, the 'controller' (eg the keyboard) and the 'sound generating module' (the bit that actually puts out the sound). MIDI information is control information; it's the messages sent from a keyboard, say, to a sound generator in a synth. If you press a 'D' on a keyboard, for example, this information is sent from the MIDI-out socket ('play a D') and goes to the sound-generator of another synth via its MIDI-in socket. Both synths then play a D.

When you connect two synths this way (MIDI-out from one to MIDI-in on the other), the keyboard on the second instrument is not active (control info is coming from the first keyboard), so no MIDI-out information is present at the second (slave) keyboard's MIDI-out socket. End of the line.

However, the clever people who developed the MIDI specification realised you might want to connect more than two instruments, so they included a MIDI-thru socket which is basically a replica of that control info coming into the MIDI-in from the first keyboard. Using MIDI-thru, therefore, you can pass control info down a 'chain' of instruments — MIDI-out to MIDI-in, MIDI-thru to MIDI-in, MIDI-thru to MIDI-in and so on (see Figure 2 [top]).

Theoretically, this chaining can go on forever, but there's a catch. For various reasons, like the need to simplify the earthing situation, MIDI information is not transmitted *physically* from instrument to instrument. Instruments are coupled 'optically' using optocouplers, ie, the message is translated to light and back at each MIDI connection. This translation process takes time — not a noticeable amount of time for a setup which includes only a couple of instruments but it accumulates the more in-

Simon Leadley & Michael Horn

struments you chain together. If you were to chain four or five keyboards one after the other (as in Figure 2 [top]), you might notice that the last one played a little after the first.

The MIDI Thru box will alleviate this problem by allowing you to connect your instruments in a 'star' configuration, rather than a chain (see Figure 2 [bottom]). In this case, the delay caused by the optocouplers is the same for all instruments connected to the MIDI-thru ports. It doesn't accumulate, and therefore shouldn't be noticeable.

The circuitry

The Thru Box is a very simple device, really only a buffer that takes one input and provides four identical outputs. The MIDI standard uses a current loop system for the

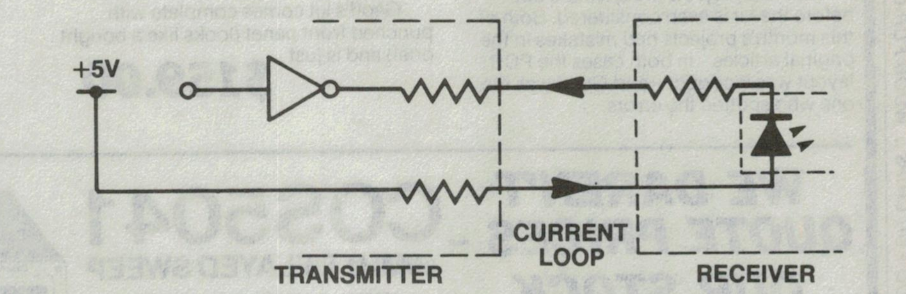


Figure 1. The current loop system; the transmitter provides the loop current and is electrically isolated to obviate loops that can cause earth hum.

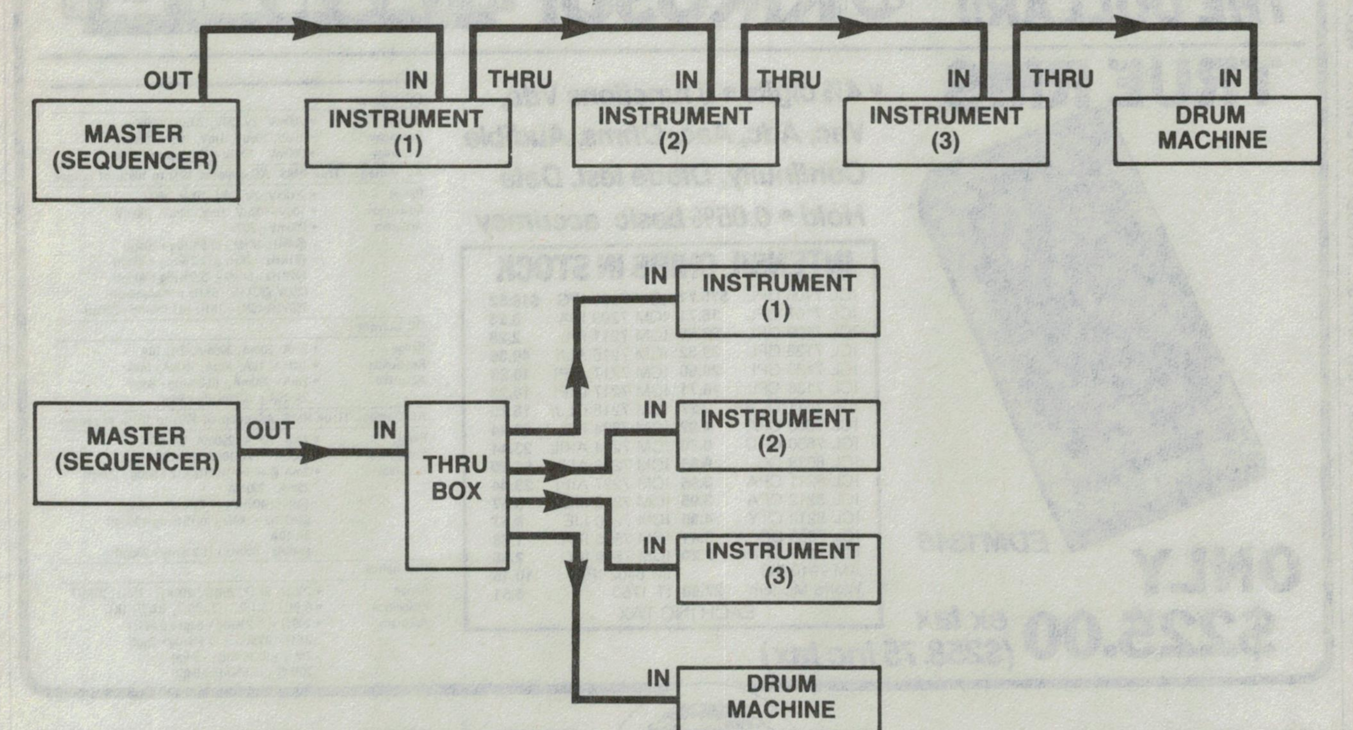


Figure 2. Setting up the Thru Box. Top is the chained arrangement without the Thru Box in which delays occur in the instruments last in the chain. Underneath shows an arrangement with no chaining delays, each instrument receives the MIDI data at the same time. An instrument may be disabled by using the MIDI disable switch on the Thru Box.

WHEN GEOFF DOES A KIT HE DOES IT PROPERLY

Geoff's policy is to do a few kits and do them well. Rather than bundle up bits and pieces for everything under the sun, Geoff takes a lot of trouble to get all the RIGHT parts for just a few projects. As a result you can be assured that there are no dubious substitutions and that all parts are prime spec.

Also the projects are checked out before the kit is even considered. Both of this month's projects had mistakes in the original articles – in both cases the PCB layout was incorrect – and Geoff was the one who spotted the errors.

AEM4600 DUAL SPEED MODEM

Geoff can't put this kit together fast enough. The queue started to form the moment the magazine came out.

Features both 300/300 baud full duplex and 1200/75 baud half duplex operation so it's ideal for Viatel. All functions are selected with quality C&K toggle switches with four LEDs to indicate correct functioning. Interfacing is standard RS232 using a minimum of signal lines for "universal" interfacing.

Geoff's kit comes complete with punched front panel (looks like a bought one!) and is just **$159.00**

ETI 169 LOW DISTORTION OSCILLATOR

If you're checking out Hi Fi systems then an audio oscillator is a must. The trouble is that the average el-cheapo probably has a higher level of distortion than a $10 transistor radio. So with this kit there can be NO compromises. The distortion just has to be better than 0.001%. Covers the frequency range to 100kHz. Geoff has checked the whole thing through with Ian Thomas (including pointing out the track error on the pcb).

Kit again includes a posh front panel and the top quality AB pot (available separately at **$9.00**).

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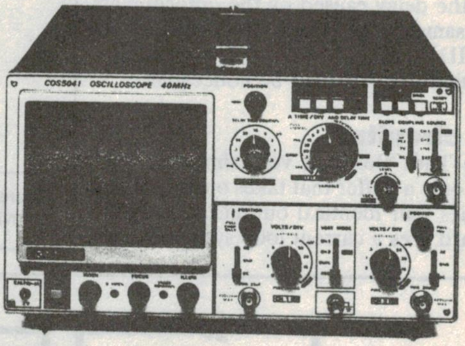

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ICL 7136 CPL	16.71	ICM 7217 CIPI	18.23
ICL 7611 DCPA	2.27	ICM 7218 CLJI	16.75
ICL 7660 CPA	4.92	ICM 7224 IPL	23.44
ICL 7650 CPD	9.76	ICM 7224 AIPL	23.44
ICL 8038 CC	9.55	ICM 7226 AIJL	66.20
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ICL 8212 CPA	3.95	ICM 7240 IJE	8.57
ICL 8212 CTY	4.95	ICM 7250 IJE	8.57
ICL 7663 BCPA	6.41	ICM 7555 IPA	1.68
ICL 7665 BCPA	7.20	ICM 7556 IPD	2.96
AM 7910 PC		IM 6402 IPL	10.15
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Accuracy	• 200mV – 1000V ± (0.05%rdg + 3dgt)

AC Voltage: (True RMS, AC coupled 10% to 100% of range)

Range	• 200mV, 2V, 20V, 200V, 750V
Resolution	• 10uV, 100uV, 1mV, 10mV, 100mV
Accuracy	• 200mV – 200V @45Hz-1KHz ± (0.5%rdg + 20dgt) @1KHz – 2KHz ± (1.2%rdg + 30dgt) @2KHz – 5KHz ± (5.0%rdg + 40dgt) (200V @2KHz – 5KHz not specified) 750V @45Hz – 1KHz ± (1.0%rdg + 20dgt)

DC Current

Range	• 2mA, 20mA, 200mA, 2A, 10A
Resolution	• 100nA, 1uA, 10uA, 100uA, 1mA
Accuracy	• 2mA – 200mA ± (0.3%rdg + 3dgt) 2A-10A ± (0.75%rdg + 3dgt)

AC Current: (True RMS, AC coupled 10% to 100% of range)

Range	• 2mA, 20mA, 200mA, 2A, 10A
Resolution	• 100nA, 1uA, 10uA, 100uA, 1mA
Accuracy	• 2mA @45Hz – 400Hz ± (2.5%rdg + 20dgt) 20mA – 200mA @45Hz-400Hz ± (0.75%rdg + 20dgt) @400Hz – 1KHz ± (0.75%rdg + 30dgt) 2A-10A @45Hz – 500Hz ± (1.2%rdg + 20dgt)

Resistance

Range	• 200Ω, 2KΩ, 20KΩ, 200KΩ, 2MΩ, 20MΩ
Resolution	• 0.01Ω, 0.1Ω, 1Ω, 10Ω, 100Ω; 1KΩ
Accuracy	• 200Ω ± (0.2%rdg + 5dgt + 0.04Ω) 2KΩ – 200KΩ ± (0.1%rdg + 3dgt) 2MΩ ± (0.15%rdg + 3dgt) 20MΩ ± (0.5%rdg + 3dgt)

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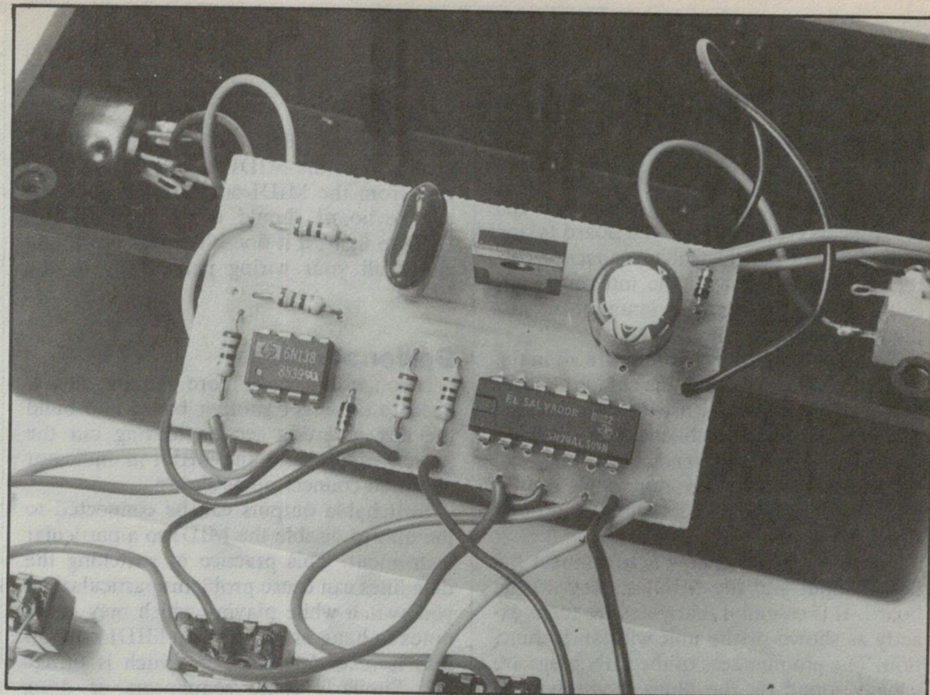
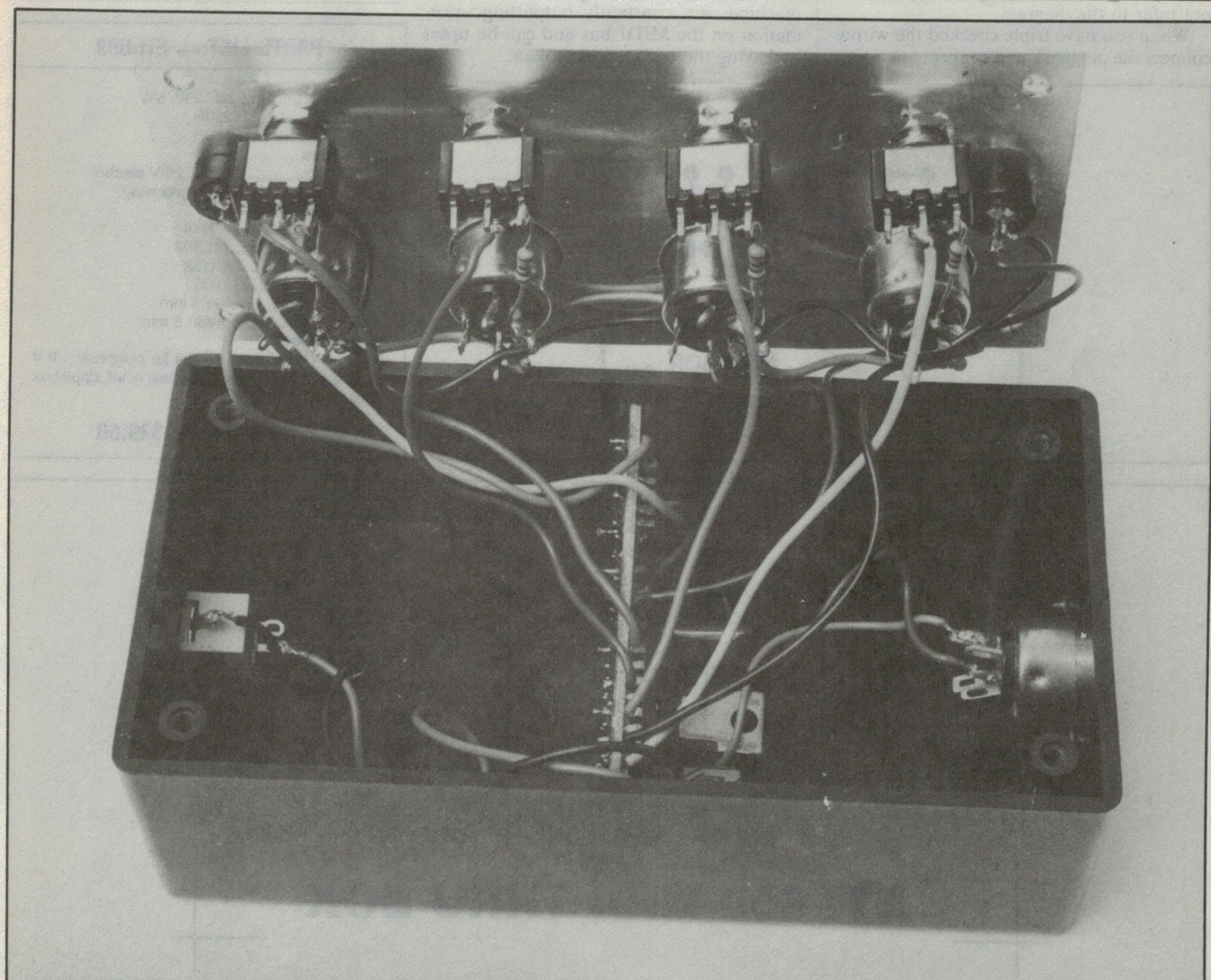
data transfer so that it is relatively immune to noise that could otherwise find its way on to the data lines, but MIDI Spec 1.0 limits the length of the connecting leads to 15 metres.

The incoming data is converted to a standard TTL level by the 6N138 optocoupler. This is buffered by the 7404 TTL hex inverter and converted to a current drive, presented at each MIDI-out socket. Four outputs are provided but this number may be increased simply by adding more of the inverter sections and connecting their inputs to the optocoupler output.

One inverter and an LED are used to provide the unit with a visual indication of incoming MIDI data.

The power supply is fed from a 9 V plugpack, filtered and regulated to give a 5 V supply. An LED is placed at the output of the regulator to give indication that power is being applied to the unit.





Construction

All the components are contained on a small pc board. Begin by placing all the resistors and capacitors on the board taking care to orient the electrolytic capacitor correctly. Next, mount all the integrated circuits, again checking the orientation against the component overlay.

When you are sure that they are all in the right place start wielding the soldering iron. Since all the resistors are the same value there should be no problems here. Wire up the LEDs with flying leads. The long lead on the LED denotes the anode so be careful that you have them the right way around when wiring them up.

All that is needed now is to connect the power input and the MIDI sockets to the board. It is essential that you wire them exactly as shown or the unit will fail to function. The pin numbers of the DIN plugs are usually found on the plugs themselves. If not refer to the diagram.

When you have triple checked the wiring connect the plugpack and confirm operation of the power LED, then connect a MIDI keyboard to the MIDI-in jack on the Thru Box from the MIDI-out. Playing notes on the keyboard should cause the MIDI-in LED to light; if it doesn't power down and check all your wiring particularly to the LEDs.

Optional extras

If you wish to have more outputs, all you need to do is get another board and build the hex inverting section leaving out the power supply and the MIDI-in indicator and then connect up as shown.

Switchable outputs can be connected to the unit to disable the MIDI to a particular instrument. This practice of switching the data lines can cause problems particularly if you switch while playing which may cause notes to hang on because no MIDI note off info is received after the switch is turned off. Similarly some sequencers or drum machines are constantly outputting information on the MIDI bus and can be upset by having the connection broken.

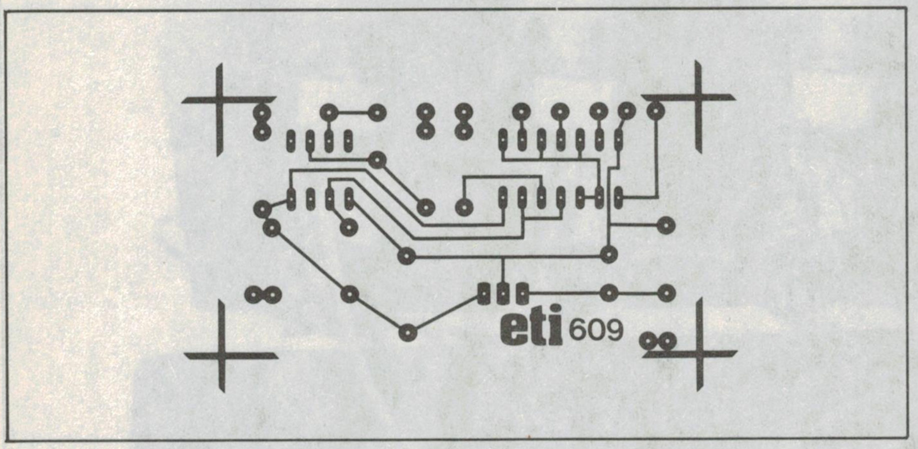
HOW IT WORKS — ETI-1609

MIDI information is applied to the input socket. A current loop is formed by the diode in the optocoupler sitting in parallel with the input pins. Diode, D1, guards against reverse polarity.

Output from the optocoupler is taken by an inverter at the beginning of the output chain. Since the 74LS04 is a TTL device up to eight inverters can be driven by the one output while still remaining within TTL rules. Provision has been made for four outputs on this board, although more could be added very simply in parallel.

The output current loop is provided via the 220 ohm resistor to pin 4 of the four output sockets, thence through the device hanging off the output and finally back in pin 5 of the Thru Box outputs. The state of the output buffers dictates whether current will flow.

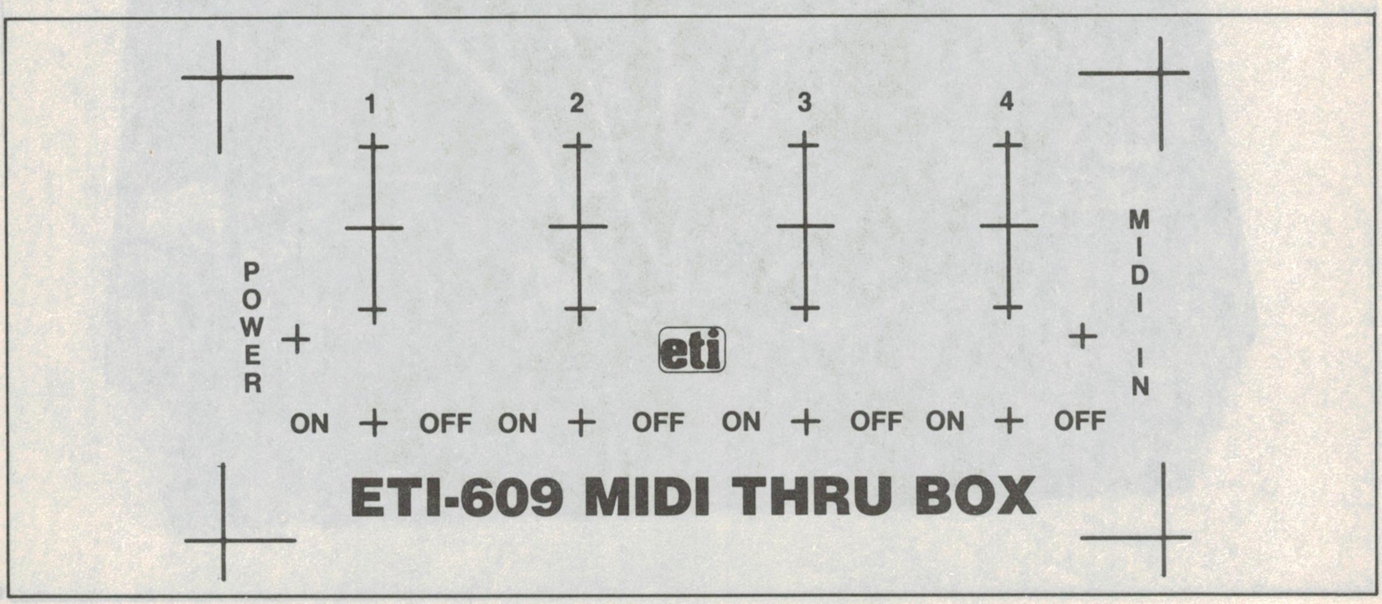
To provide an indication of whether the MIDI input is being exercised, one of the inverters on IC1 is used to drive LED2. This will light whenever pin 12 of IC1 goes high. LED1 is taken from the output of the 7805 so it provides a power on indicator. D2 functions to protect the regulator IC3 against incorrect polarity on the connection, which needs to be a 9 Vdc.

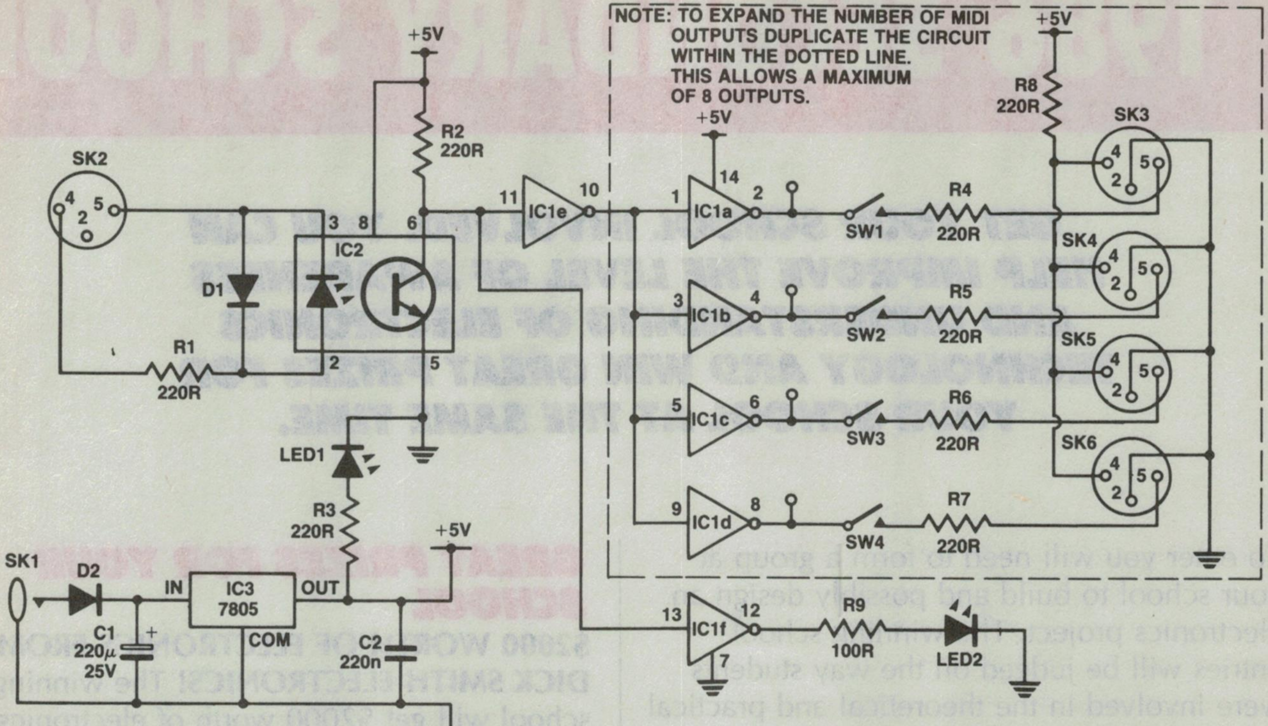


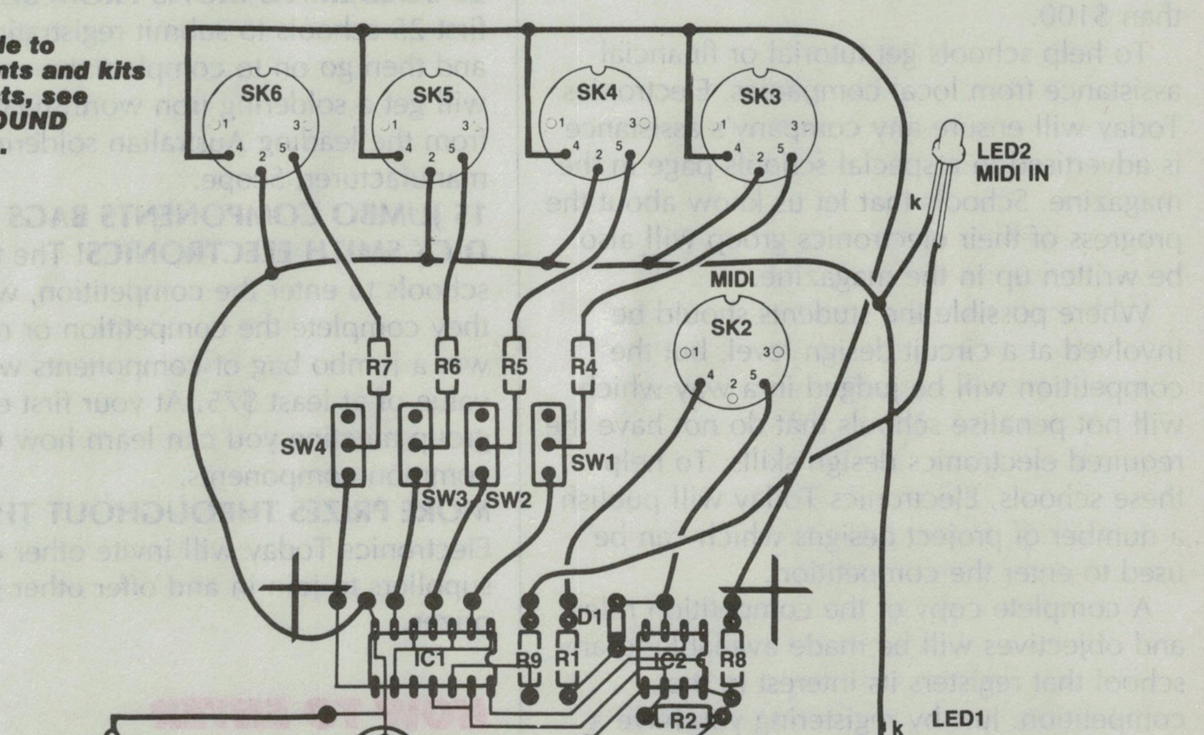
PARTS LIST — ETI-609

Resistors................all ¼ W, 5%
R1-8......................220R
R9.........................100R
Capacitors
C1.........................220µ, 25 V electro
C2.........................220n greencap
Semiconductors
D1,2......................1N914
IC1........................74LS04
IC2........................6N138
IC3........................7805
LED1 ....red 3 mm
LED2 ....green 3 mm
Miscellaneous
5 x 5-pin DIN plugs; 1 socket for plugpack; 1 9 V plugpack; 4 SPST mini switches; small zippy box (310 x 182 x 105 mm).

Price estimate: $29.50







For a guide to components and kits for projects, see SHOPAROUND this issue.

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Where possible the students should be involved at a circuit design level, but the competition will be judged in a way which will not penalise schools that do not have the required electronics design skills. To help these schools, Electronics Today will publish a number of project designs which can be used to enter the competition.

A complete copy of the competition rules and objectives will be made available to any school that registers its interest in the competition. Just by registering you have a chance of winning electronics products for use by your school. Copies of the rules have also been sent to either the principal or science teacher at your school.

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SIMPLE FORTH CONTROLLER BOARD

This 65F12 system is designed as a minimum controller board. It can be used as a target for the Forth computer described in May 1985 or can be programmed directly using the extended 6502 instruction set.

David Jenkinson

REGULAR READERS OF ETI will remember the ETI-694 Forth computer published in May 1985, and the ETI-696 extension card and disk drive from December 1985. The latest of our Forth projects is a controller board. In fact this is probably the key project of the entire series, because it utilises Forth in the optimum way, in controlling equipment in the external world.

As before, the resident micro is the 65F12, which consists of a 6502 with some user RAM and Forth in ROM. The board also contains up to 8K of RAM and ROM, a watchdog timer, RS232 serial link and provision for battery back-up.

To reduce cost, an initial design constraint was to keep this a minimal system, but at the same time allow for additional system expansion boards. A look at the parts list will show that only seven ICs have been used, allowing a board size of only 140 mm by 86 mm. Connectors J2 and J5 have all the necessary signals for additional boards. Functions such as analogue I/O, and bank-switched memory can be added later.

This article will not contain a complete description of Forth, or indeed, even of the Energy Control system. If you want to get to know Forth we suggest you consult *Starting Forth* by Leo Brodie ($25), or *Forth Programming* by Leo Scanlan ($24.25). Both are available through ETI book sales. (See the advertisement pages 98, 99.) For a better understanding of how these Forth boards work in practice, you should consult the relevant articles in ETI, and obtain a copy of the RSC Forth user's manual available from Energy Control. Incidentally, the Queensland Institute of Technology teaches Forth quite extensively.

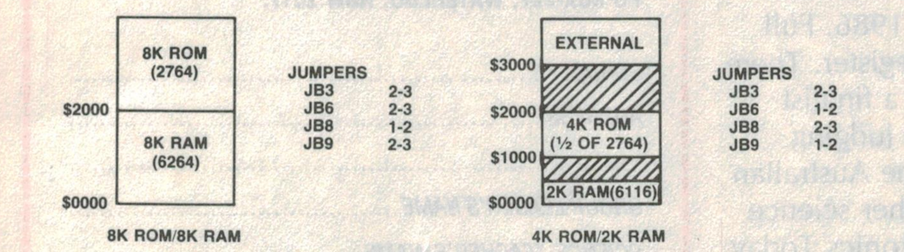
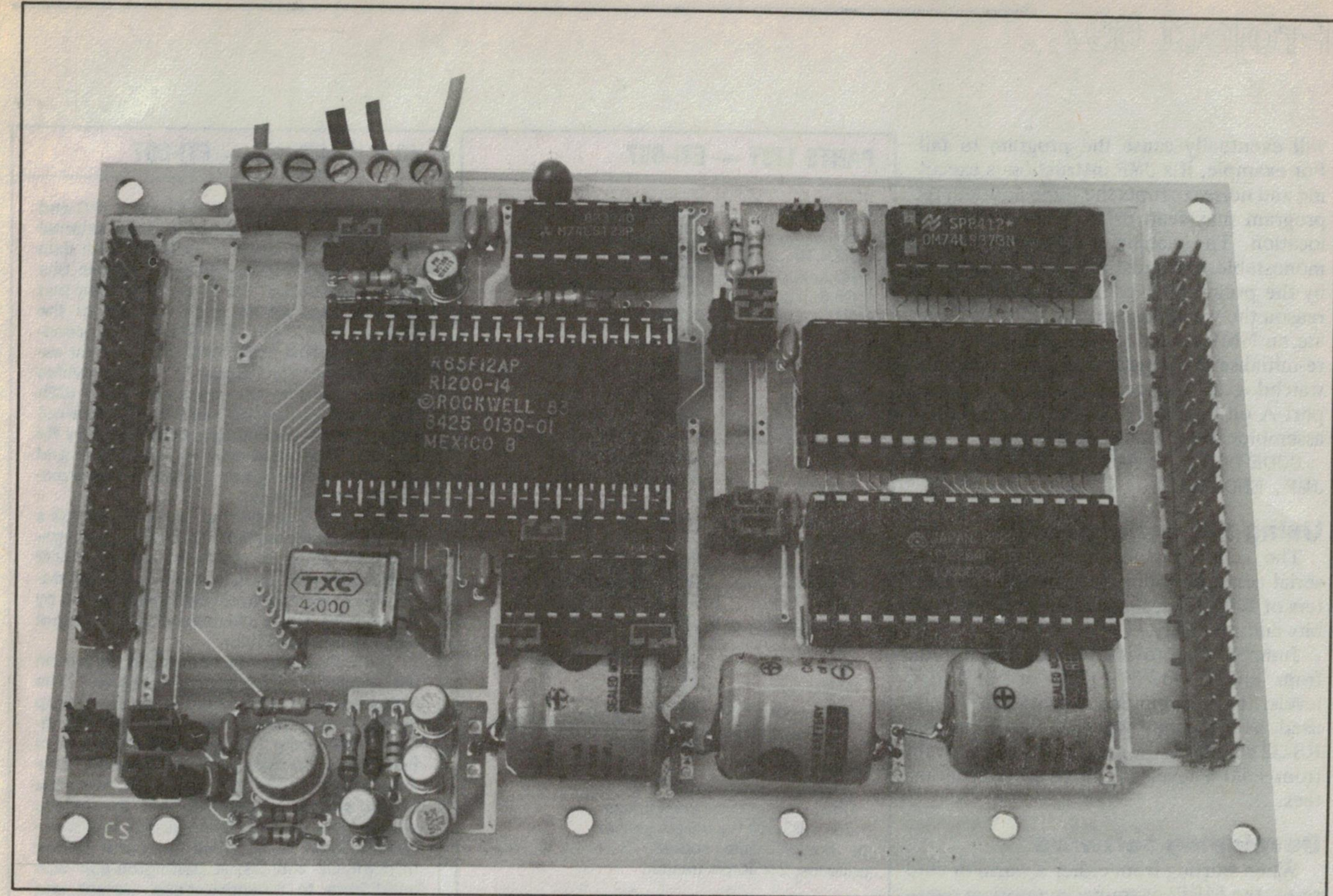


Figure 1. Example memory configuration table.

Construction

The double sided pc board from Energy Control is silk screened to proper professional quality. However, it is still a good idea to check it thoroughly before you begin construction. When you are happy with it, proceed to load the board in the usual way. Place the resistors, IC sockets, and pin headers in their correct positions and solder home. Notice that the 65F12 comes in a 64-pin package, with its pins in a staggered configuration, so a conventional socket won't work. Also note, one of the pin headers needs surgery, to break it into a 40-pin section and 4-pin section, (JB3).

Next, insert the capacitors. Notice that one of these is tantalum, so its polarity is important. On most brands a small '+' sign is visible just above the appropriate leg. The other polarised component is the diode.



The project won't work if you get it wrong!

Next, install the transistors, and slip the chips into their sockets. Be careful, once again, to get polarity correct. Also notice that the processor is an NMOS device, so take special care of it. Don't remove it from the foil until absolutely necessary. In fact, it's good practice not to even touch these devices until you need them.

At this stage, go over your work carefully, making sure that your soldering is up to scratch and all components are where they should be. A bit of time spent at this stage will save a mountain of tears and frustration later.

When you're happy with this, install the batteries, then the jumpers as required and hook it up. Now you should be ready to test it.

Testing the board

A convenient way of checking the board is to configure the jumpers for 8K memory chips (see Figure 1) using the Rockwell 65FR1P development ROM in the IC6 socket. If a terminal is connected to the serial port, the system will look like an RSC-Forth development system. See under the heading 'Using the serial port' for the correct protocols.

If the watchdog timer is connected the system will display RSC-Forth as normal, but after a five second delay the message will reappear. This occurs because at power-on, the non-maskable interrupt vector (NMI) is set to point to the system reset routine. (So when an NMI occurs the system resets.)

If you do not have a development ROM things become a bit tedious. There is a micro-monitor in the 65F12 chip which can be accessed by typing CNTL R ($12) from the terminal. A > prompt indicates the micro-monitor is operational. Details of how to use this monitor can be obtained from the RSC-Forth user's manual available from Energy Control.

Memory configuration

One limitation of the RSC-Forth development board is that Forth code cannot be generated to reside in the upper 8K of external memory. If you wish to use the full 8K ROM space, 6502 machine code will have to be used.

The normal configuration to run Forth target-code is 4K RAM and 4K ROM. Not all applications require RAM. In these cases just the 4K ROM need be inserted. 4K may not sound like much but let me assure you, 4K of headerless Forth is a *lot* of code. The 65F12 kernel already contains the Forth primitives so all your code must provide is a series of jumps to existing Forth words. Several possible memory configurations are shown in Figure 1.

If the processor is running at 2 MHz (4 meg crystal), the multiplexed data and address bus structure requires fast memory devices. It is essential that you use ROMs with an access time of at most 250 ns. If the process is run at 1 MHz (2 meg crystal), slower memory may be used. It may be difficult to obtain 2K or 4K chips with 250 ns access time. 250 ns 8K EPROMs (2764) are readily available. If 8K chips are used in the 4K configuration, it is the top 4K of the ROM that will be addressed.

Battery backup

The board has provision for backup of the RAM in IC7 and the 192 bytes of internal RAM in the 65F12. Jumpers, JB5 and JB1, may be used to select either +5 volts or Vbatt. If the battery backup circuitry is not installed, leave the jumpers in the +5 volt position. JB4 on the ROM socket was included for possible future expansion and should be left in the +5 volt position.

Using the watchdog timer

The concept of a watchdog may be unfamiliar to many readers. However, it is a technique frequently used by industry. If a processor is running continuously there is some probability that noise on the system ▶

will eventually cause the program to fail. For example, if a JMP instruction is executing and noise corrupts the jump address, the program may leap off to some undefined location. The watchdog is a retriggerable monostable that must be reset periodically by the program. If control is lost for some reason the watchdog will time-out and initiate an NMI sequence. This can be used to re-initialise the program. On this system the watchdog is triggered by pulsing bit 1 of port A on the 65F12. The following Forth-assembler word should do the trick.

```
CODE DOG PA 1 RMB, PA 1 SMB, NEXT
JMP, END-CODE
```

Using the serial port

The serial port uses three-wire RS232 serial communication with default parameters of 2400 baud, seven data-bits, two stop-bits and no parity.

Jumpers are provided to allow operation from either +12 V/−12 V or +5 V/0 V levels. It is recommended that +12/−12 be used, as the output will then be within true RS232 standards. Some devices will operate from +5/0 V levels but there are no guarantees.

Developing software

When starting from either a warm or cold reset, the 65F12 examines memory at every 1K boundary for $A55A bit pattern. This pattern indicates an auto-start ROM is installed. The following two bytes must point to the parameter field of the Forth word to be executed on reset.

PARTS LIST — ETI-697

Resistors	all ¼ W, 5%
R1	47k
R2,4,10	100k
R3	10k
R5,6	4k7
R7	2k7
R8,9	1k
R11	10M
R12	220R
Capacitors	
C1	100 nF greencap
C2	10 µF tantalum
C3	68 µF tantalum
C4	not required
C5,6	15 pF
C7-14	100 nF ceramic
Semiconductors	
D1	IN914
Q1,5	BC108,BC548
Q2-4	BC179
IC1	LM393
IC2	74LS123
IC3	65F12AQ 2 MHz part*
IC4	74LS139
IC5	74LS373
IC6	2764, 2732, 2716 (250NS)
IC7	6264, 6116
Miscellaneous	
XTAL1	4 MHz
JB2	2-pin jumper
JB1, JB3-JB11	3-pin jumper

pc board*; Quip socket*. 3 x 1.2 V nicad batteries; 2 x 50-pin header.

Price estimate: $105

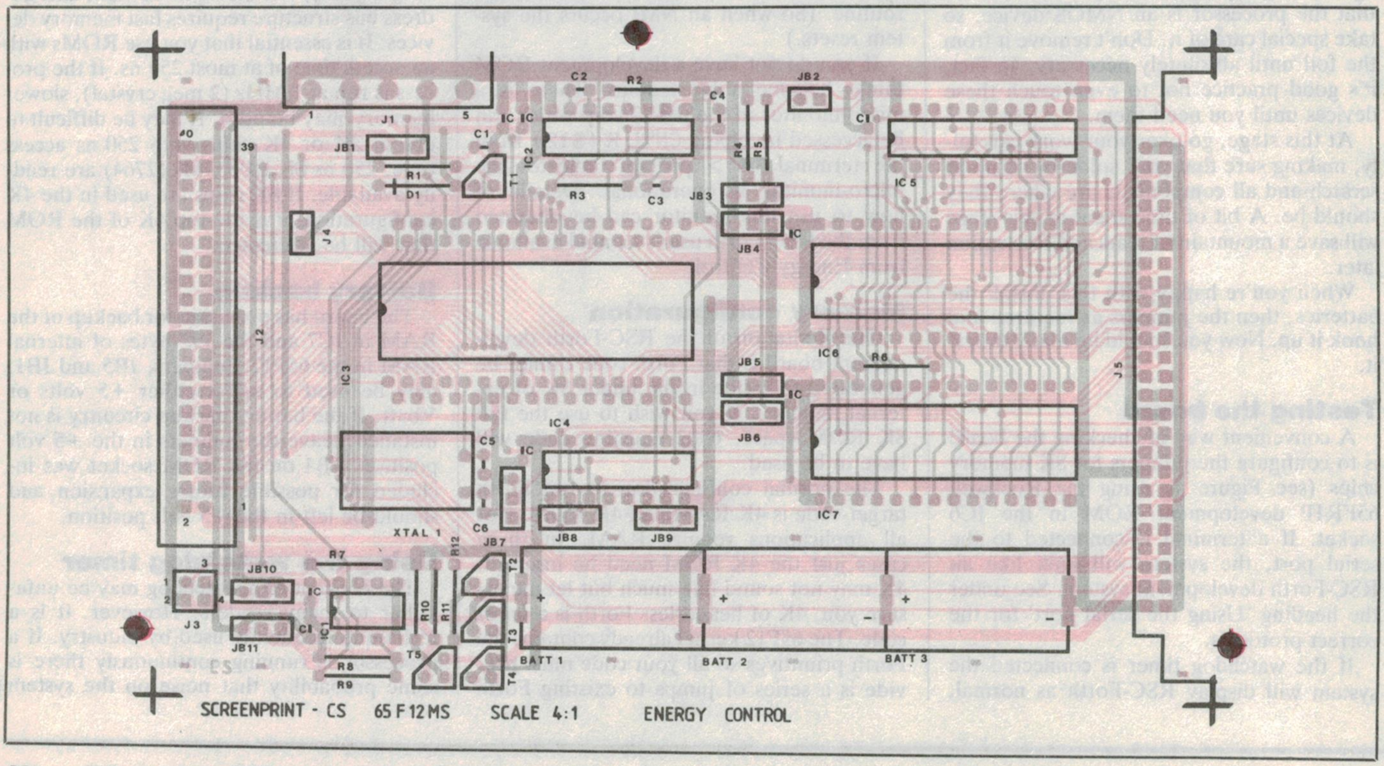
*Available from Energy Control, 73 Eric St, Goodna, Qld 4300. (07)288-2455. See special offer page 64.

HOW IT WORKS — ETI-697

The 65F12 uses several of its ports (PC and PD) to address external devices. An external 16K of address space is available, with data and the eight least-significant address bits being multiplexed. IC5 is an 8-bit latch that demultiplexes A0-A8 under control of the EMS signal (IC3 pin 32). IC4 provides decoding for the ROM (IC6), RAM (IC7), and an external device select signal EXT IC2a provides a reset signal to the processor while IC2b provides the watchdog function. The time-out period for the watchdog is determined by R4 and C3. The actual time is not critical and with the values given should be approximately five seconds.

RS232 RXD is inverted by Q1 to provide a TTL compatible signal. D1 clamps the negative excursions of the input signal. RS232 TXD is provided by IC1, which is a comparator. The switching threshold is determined by R8 and R9. R7 is necessary as the output stage is open-collector.

The battery-backup circuitry is based on the simplified circuit shown in Figure 3. The disadvantage of this circuit is the 7 volt drop across each diode. This is of some significance when only 3.6 volts are available from the nicads. To overcome this problem transistors were used. Q5 turns on Q4, when the 5 volt supply is present, and the nicads charge through R12. When supply is disconnected Vbatt is supplied from the nicads through Q2 and Q3. A Darlington-pair was used here to minimise base current and hence power dissipation in R11. R6 is provided on the RAM socket to pull up CS during battery backup. If this is not provided the RAM will not operate in power down mode, and current will be excessive.



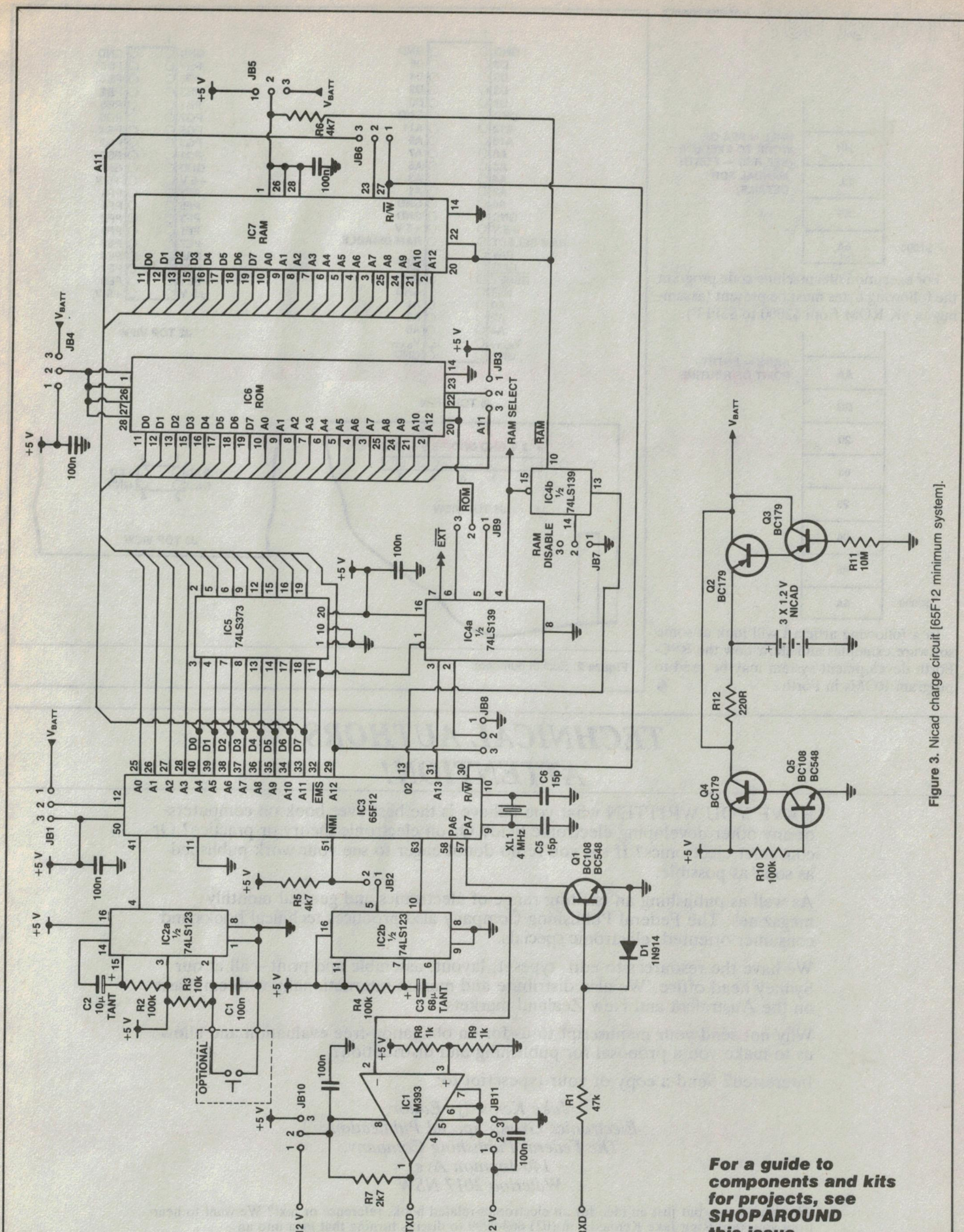
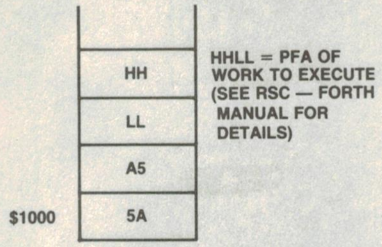
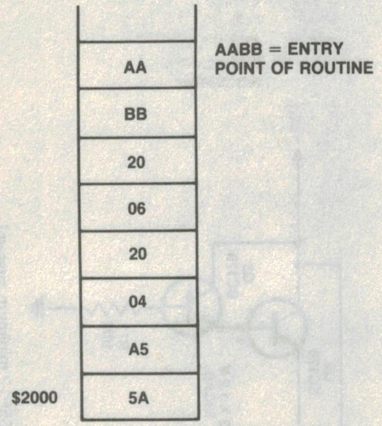


Figure 3. Nicad charge circuit [65F12 minimum system].

For a guide to components and kits for projects, see SHOPAROUND this issue.



For execution of a machine code program the following bytes must be present (assuming an 8K ROM from $2000 to $3FFF).



In a following article I will look at some software examples and show how the RSC-Forth development system may be used to program ROMs in Forth. ●

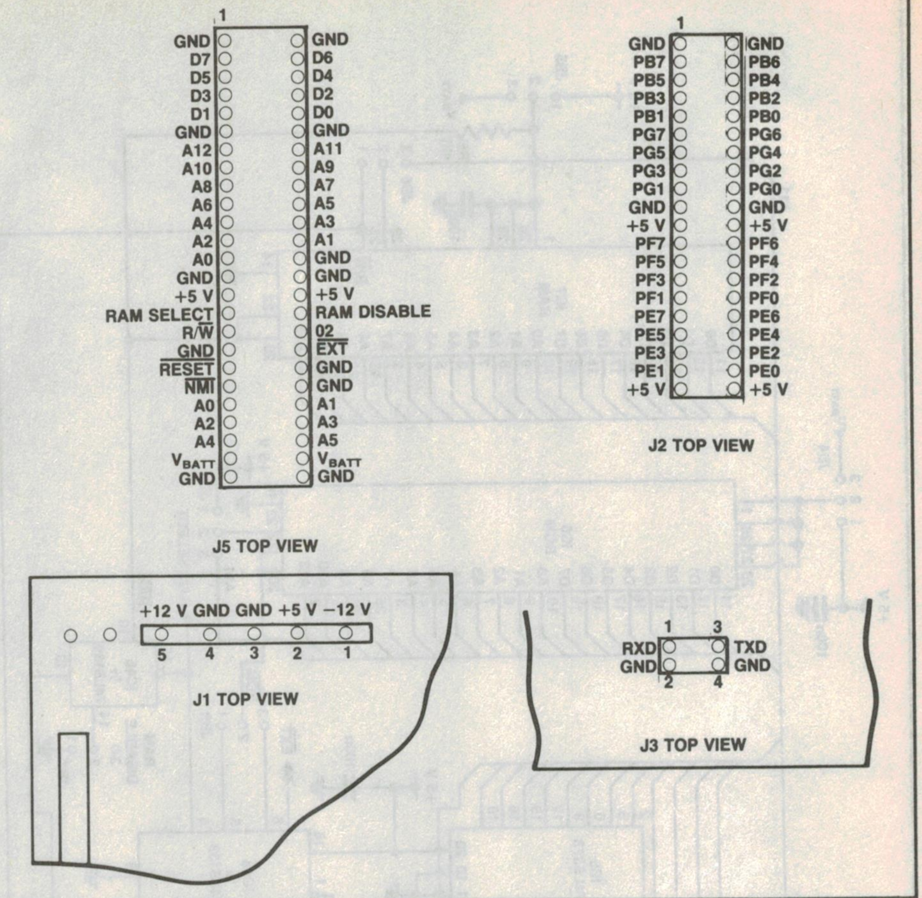


Figure 2. Socket numbers.

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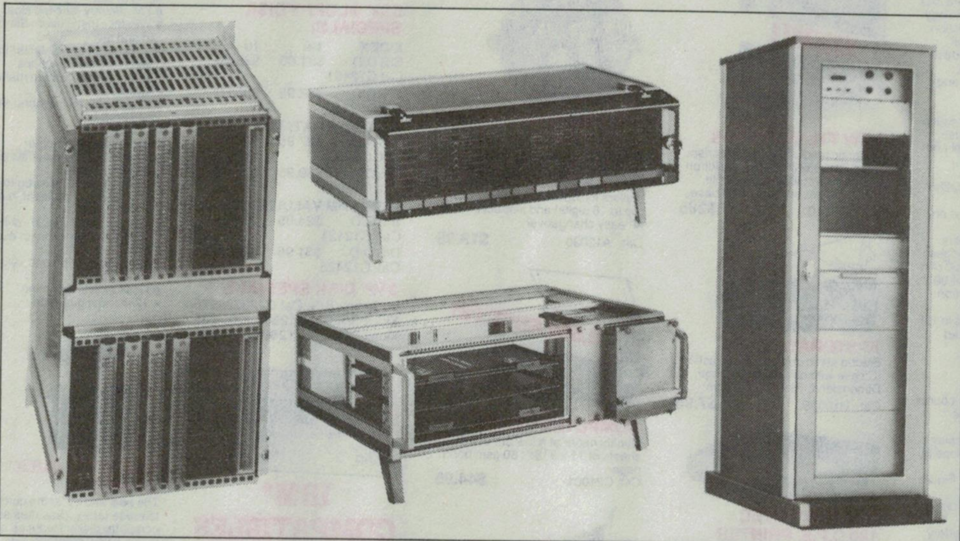

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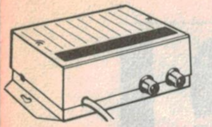

UHF/VHF/FM ANTENNA AMPLIFIER AND 2 WAY SPLITTER.

Covers all Australian frequencies. Suitable for use in houses, caravans, boats etc.
- 1 x 75 ohm input.
- 2 x 75 ohm output.
- Gain 2 x 6dB.
- Maximum output 2 x 96dBuV.

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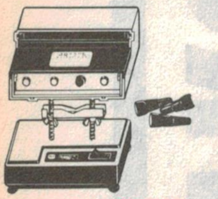
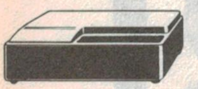


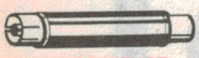
UHF/VHF MAST HEAD AMPLIFIER

SPECIFICATIONS.
Gain: 40 - 160MHz 30dB (rejection 7.5dB at 94MHz) 170 - 230MHz 40dB 470 - 900MHz 15dB
Max Output: 100dB uF V
Noise Figure: VHF 6.5dB UHF 7dB
Input Impedance: VHF (75/300 ohm) UHF (75/300 ohm)
Output Impedance: 75 ohm
Power Supply: 12V DC 100mA
Cat. L15046 **$89.95**



UHF/VHF CONVERTER

SPECIFICATIONS:
Input (Channel 36): 75 ohm x 1.
Output (Channel 1,3,4): 75 ohm x 1
Gain: 12dB.
Power Supply: AC adapter 240V AC, 50Hz/12V DC, 100mA, DC Plug.
Cat. L15051 **$89.95**



TV INTERFERENCE FILTER

Cuts CB/Ham signals interference.
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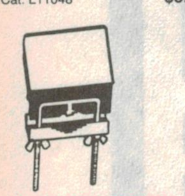

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Suits all TV's and allows VHF sets to watch and listen to SBS Channel 28
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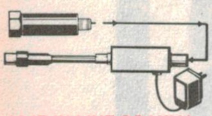
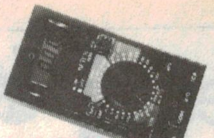
- Power supply 12V DC 100mA (included).
- Allows TV without UHF to recieve on-air UHF signal or use VCR, Video Game, Computer, etc.

Cat. L15021 **$99**



10dB IN-LINE COAXIAL AMPLIFIER

Reduces loss from splitters and long cable runs. Suitable for use with antennas, coaxial feed lines and VCR's. A/C adaptor included.
SPECIFICATIONS:
Frequency Range: 5-900MHz
Gain: 10dB
Power Requirements: 12V A/C Adaptor (included)
Input Impedance: 75 ohm
Output Impedance: 75 ohm
Cat. L15043 **$44.95**



METEX 3530 MULTIMETER

This instrument is a compact, rugged, battery operated, hand held 3 1/2 digit multimeter for measuring DC and AC voltage, DC and AC current, Resistance and Diode, Capacitance, Transistor hFE and Continuity Test. The Dual-slope A-D Converter uses C-MOS technology for auto-zeroing, polarity selection and over-range indication. Full overload is provided. It is an ideal instrument for use in the field, laboratory, workshop, hobby and home applications.

Features...
- Push-button ON/OFF power switch.
- Single 30 position easy to use rotary switch for FUNCTION and RANGE selection.
- 1/2" high contrast LCD.
- Automatic over-range indication with the "1" displayed.
- Automatic polarity indication on DC ranges.
- All ranges fully protected plus Automatic "ZERO" of all ranges without short circuit except 200 ohm Range which shows "000 or 001".
- High Surge Voltage protection 1.5 KV-3 KV.
- Capacitance measurements to 1pF
- Diode testing with 1 mA fixed current.
- Audible Continuity Test.
- Transistor hFE Test.

SPECIFICATIONS
Maximum Display: 1999 counts 3 1/2 digit type with automatic polarity indication.
Indication Method: LCD display.
Measuring Method: Dual-slope in A-D converter system.
Over-range Indication: "1" Figure only in the display.
Temperature Ranges: Operating 0-C to +40-C
Power Supply: one 9 volt battery (006P or FC-1 type of equivalent)
Cat. Q91540 **$129**

MIDRANGE HORNS

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Two sizes to choose from:
Size: 4" x 10 1/2"
Impedance: 8 ohms
Rating: 30 watts RMS
Response: 1.5kHz - 14 kHz
Dimensions: 102 x 267 x 177mm
Cat. C92082 **$49.95**

Size: 3" x 7"
Impedance: 8 ohms
Rating: 30 watts RMS
Response: 2kHz - 15 kHz
Dimensions: 76 x 177 x 145mm
Cat. C92084 **$29.95**

Dealers, OEM's, etc., phone (03) 543 166 for wholesale prices.

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Description	1-9	10+
LM309KC	$1.80	$1.60
7805KC	$1.80	$1.60
7812KC	$1.80	$1.60
78H05KC 5V 5A	$7.80	$6.95
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S13022	2 pol 2-6 pos.	$1.95
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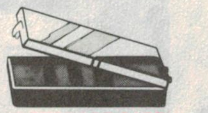

IC STORAGE CASE

Electro static charge proof plastic IC case with conductive sponge. Dimensions: 75 x 130 x 19mm.
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Cat. C20020 **Only $499**

SUPER HORN TWEETER

- Requires no crossover and handles up to 100W!
- Sensitivity: 100dB/0.5m
- Frequency Response: 3kHz-30kHz
- Impedance: 8 OHMS
- Size 96mm diameter

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On Special at $14.95

SUPER HORN

- Wide dispersion tweeter, handles up to 100W.
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- Frequency Response: 3kHz-30kHz
- Impedance: 8 OHMS
- Size: 145x54mm

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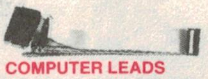

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- Length 2.4 metres

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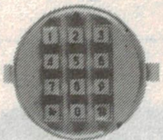

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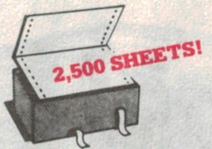

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12V DC, 8W

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- Multi-function, built in siren or external siren, car signal horn output.
- Easy to install, no door switch required.
- Automatic reset after 60 seconds (avoids noise pollution)
- Special sensor protects Stereo or CB.
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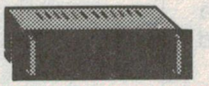

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S/S D/D Cat. C12501	$27.95	$26.95
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S/S D/D Cat. C12421	$24.95	$22.95
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Verbatim S/S Cat.C12372 $75
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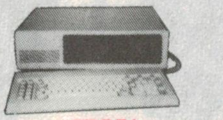

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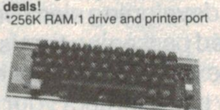
*256K RAM,1 drive and printer port



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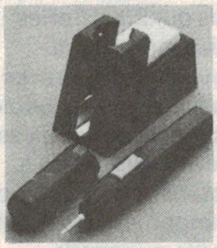
- For Apple
- 42 single key BASIC command
- One chip custom design encoder
- Made by ALPS, life time, 10 million operations
- Dimension: L340xW110xH42mm

Cat. K12010 **$79.50**

- For Apple
- 45 built in function keys, BASIC and CP/M command.
- 45 user defined keys
- Built-in shift lock
- Made by ALPS, life time, 10 million operations
- Dimension: L340xW130xH42mm

Cat. K12012 **$99.00**



CORDLESS RECHARGEABLE SOLDERING IRON

- Built in solder point illumination
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- Protective stand which also functions as charging unit
- Sponge pad attach to stand
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Ideal for games or word processing. Fits most 6502 "compatible" computers.
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Perfect for home, office, shop, farm, factory, front door security, granny flat, etc.
FEATURES:
- FM circuitry for crisp clear sound
- Wireless installation. Simply plug in and talk.
- Fully automatic: selects "transmit" and "recieve" functions automatically without manual switching.
- Condensor microphone with high sensitivity.
- Call signal.
- Power on/off indicator.
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Suitable for IDC connectors.

Cat.No.	Description	$/metre
W12714	28AWG 14W	$1.80
W12716	28AWG 16W	$1.80
W12720	28AWG 20W	$2.20
W12726	28AWG 26W	$2.90
W12734	28AWG 34W	$3.60
W12740	28AWG 40W	$4.40

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Features 2x150K pots, long shaft 40mm with 25mm control ball. Bonus adjustable offset feature on pots.

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W11251 13/.12 TND BLK
W11252 13/.12 TLD BROWN
W11253 13/.12 TLD ORANGE
W11254 13/.12 TLD YELLOW
W11255 13/.12 TLD GREEN
W11256 13/.12 TLD BLUE
W11257 13/.12 TLD WHITE
PRICES PER 100 METRE ROLL
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PRICES PER 100 METRE ROLL
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INDIVIDUAL COMPONENTS TO MAKE UP A SUPERB HIFI SYSTEM!

By directly importing and a more technically orient...
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WHILE OUR CURRENCY IS DEVALUING PRICES WILL RISE, SO BE QUICK!

... we also ... kits assembled and tested.

POWER AMPLIFIER

WHY YOU SHOULD BUY A "ROD IRVING ELECTRONICS" SERIES 5000 POWER AMPLIFIER....

- 1% Metal Film resistors are used where possible.
- Alumimium case as per the original article.
- All components are top quality.
- Over 1000 of these kits now sold.
- Super Finish front panel supplied at no extra cost.

Please note that the "Superb Quality" Heatsink for the Power Amplifier was designed and developed by ROD IRVING ELECTRONICS and is being supplied to other kit suppliers.

SPECIFICATIONS: 150 W RMS into 4 ohms
POWER AMPLIFIER: 100W RMS into 8 ohms (+−55V Supply)
FREQUENCY RESPONSE: 8Hz to 20Hz +0=.0.4 dB 2.8Hz to 65KHz, +0=3 dB. NOTE: These figures are determined solely by passive filters.
INPUT SENSITIVITY: 1 V RMS for 100W ouput.
HUM: 100 dB below full output (flat).
NOISE: 116 dB below full output (flat, 20KHz bandwidth).
2nd HARMONIC DISTORTION: ‹0.001% at 1 KHz (0.0007% on Prototypes) at 100W ouput using a +=56V SUPPLY rated at 4A continues ‹0.0003% for all frequencies less than 10KHz and all powers below clipping.
TOTAL HARMONIC DISTORTION: Determined by 2nd Harmonic Distortion (see above).
INTERMODULATION DISTORTION: 0.003% at 100W. (50Hz and 7KHz mixed 4:1).
STABILITY: Unconditional.

Cat. K44771 **Will be $359, limited stock available at $339**
Assembled and tested $549
packing and post $10

PREAMPLIFIER

THE ADVANTAGES OF BUYING A "ROD IRVING ELECTRONICS" SERIES 5000 PREAMPLIFIER KIT ARE....

- 1% Metal Film Resistors are supplied.
- 14 Metres of Low Capacitance Shielded Cable are supplied (a bit extra in case of mistakes).
- English "Lorlin" switches ae supplied (no substitutes here.)
- Specially imported black anodised aluminium knobs.

Available Assembled and Tested. (We believe that dollar for dollar there is not a commercial unit available that sounds as good!)

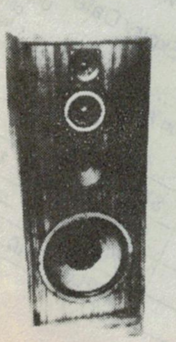
SPECIFICATIONS:
FREQUENCY RESPONSE: High-level input: 15Hz = 130KHz, +0.=1dB Low-Level input-conforms to RIAA equalisation +=0.2dB
DISTORTION: 1KHz ‹0.003% on all inputs (limit of resolution on measuring equipment due to noise limitation).
S/N NOISE: High-Level input, master full, with respect to 300mV input signal at full output (1.2V)›92dB flat ›100dB A-weighted, MM input, master full, with respect to full output (1.2V) at 5mV input 50ohms source resistance connected: ›86dB flat/92dB A-weighted MC input, master full, with respect to full output (1.2V) and 200uV input signal: ›71dB flat ›75dB A-weighted.

Cat. K44791 **Will be $319, limited stock availble at $299**
Assembled and tested $599
packing and postage $10

THIRD OCTAVE GRAPHIC EQUALIZER

SPECIFICATIONS:
BANDS: 28 Bands from 31.5Hz to 16KHz.
NOISE: ‹0.008mV, sliders at 0, gain at 0(=103dB0).
20KHz BANDWIDTH DISTORTION: 0.007% at 300mV signal, sliders at 0, gain at 0, maximum 0.01%, sliders at minimum.
FREQUENCY RESPONSE: 12Hz=105KHz, +0,=1dB, all controls flat.
BOOST AND CUT: 14dB

Cat. K44590 1 unit: **will be $219, limited stock availble at $199**
2 units: **will be $429, limited stock available at $194**
packing and postage $10



SERIES 4000 SPEAKERS

8 Speakers On **$349**
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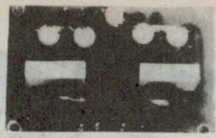


GENERAL PURPOSE PREAMPLIFIER

A general purpose stereo preamplifier using a single LM382 IC which can be tailored for use with magnetic pickups, tape recorders or microphones by changing a few components. (ETI445) (ETI July '76)

Cat. K44490 **$9.95**

GENERAL PURPOSE AMPLIFIER CLASS B

One of the handiest 'tools' for the electronics experimenter is a genuine purpose audio amp. This module will work from a wide range of supply voltages, has good sensitivity, is robust and reliable - easy to build too! (ETI 453) (ETI April '80)

Cat. K44530 **$14.95**

150W MOSFET POWER AMPLIFIER

Here's a high power, general purpose 150W Mosfet Power Amp Module! Suitable for guitar and P.A. applications and employing rugged, reliable Mosfets in the output stage. (ETI 499) (ETI March '82)

Cat. K44990 **$97.50**
(Heatsink not included)
plus transformer **$49.50**

EA AM STEREO DECODER

AM stereo is now broadcast in Australia on an experimental basis. This add-on decoder works with the Motorola C-QUAM system. (EA Oct.'84) 84MS10

Cat. K84100 **$26.95**

EFFECTS UNIT

An "effects unit" that can create phasing, flanging, echo, reverb and vibrato effects. (EA June.'83) 83GA6

Cat. K83060 **$89.00**

4 INPUT PREAMP

Easy construction and versatile operation, this preamp is for coupling with the 300W "Brute" Power Amp. (ETI 467) (ETI July '80)

Cat. K44670 **$54.95**

BALANCED INPUT PREAMP

This project can be used as a balanced mic amp. with low impendance input, a low or high impendance input differential amplifier or a balanced input instrumentation amplifier. (ETI-461) (ETI Dec.'82).

Cat. K44610 **$19.95**

PLAYMASTER 300 WATT AMPLIFIER

This module will deliver up to 200 watts into an 8 ohm load and up to 300 watts into a 4 ohm load. Comprehensive protection is included and a printer circuit board brings it all together in a rugged easy-to-build module. It can be built in either fully-complemetary or quasi-complementary versions, so output transistor shortages should be no problem at all. (80PA6) (EA July '80)

Cat. K80060 **$97.95**

SERIES 4000 STEREO PREAMP

This high performance project is designed to complement ETI's 60 watt low distortion amplifier module and forms part of a complete stereo system, the "Series 4000" project. (ETI 471) (Top Projects Vol. 6)

Cat. K44710 **$59.95**

Sensational New Microbee Kit

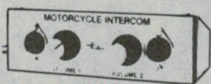
MICROBEE ENHANCER 1

This amazing kit for the Microbee is a must for all Microbee owners!
Most expansion units up to this time offered at best only one or other features; and this made it impossible to run, for example, complex sound effects mingled with speech. The Enhancer 1 will do all this and much more as well. It is quite amazing how much has been shoe-horned into this compact unit.
The Enhancer 1s' many powerful features inlcude....

- Two ATARI/COMMODORE/COLECO/SEARS type joystick inputs.
- Two TRS COLOUR COMPUTER type joystick inputs.
- Allows the connection of Touch Pads, Paddles, Proportional Joysticks, Trakballs, Mice, temperature senors, lights level sensors, transducers, etc, etc!!
- A 4 voice music/sound effects sythesizer.
- A real time clock.
- Unlimited vocabulary speech synthesizer (option).
- Parallel printer interface (option)
- A built-in speaker with volume control.
- Listings of all necesary routines for use.
- An impressive demonstration program package.
- Compatible to all Microbees.
- Digital recording and playback of speech and sound.
- An 8 channel analog to digital converter with variable voltage or variable resistance type analog inputs and also user selectable resolution from 1 to 9 bits.
- A digital to analog converter with selctable resolution from 1-8 bits.
- Allows automatic data acquisition and logging.
- 5 digital input lines, 4 digital ouput lines.
- A voice input channel.
- A 40 pin experimenter socket with all 8 analog inputs, 5 digital inputs, 4 digital ouputs, 3.58 MHz buffered clock, sound output (so that you can play the sound effects through your HI FI), 3 high resolution voltage comparators, DAC output etc.

The amazing Microbee Enhancer is available exclusively from Rod Irving Electronics.

$149



MOTORCYCLE INTERCOM

OVER 300 SOLD!
Motorcycling is fun, but the conversation between rider and passenger is usually just not possible. But build this intercom and you can converse with your passenger at any time while you are on the move. There are no "push-to-talk" buttons, adjustable volume and it's easy to build! (EA Feb.'84) 84MC2

Cat. K84020 **$45.00**

RAILMASTER PULSE POWER TRAIN CONTROLLER

Here's an up-to-the-minute train controller offering all the most desirable features including inertia, full overload protection, walk-around throttle and excellent low-speed running characters. Probably the best controller available, regardless of the cost! (EA Sept.'84) 84TC9

Cat. K84091 **$79.50**

ELECTRONIC MOUSETRAP

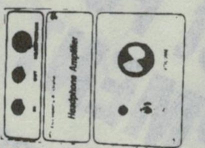
This clever electronic mousetrap disposes of mice instantly and mercifully, without fail, and resets itself automatically. They'll never get away with the cheese again! (ETI Aug.'84) ETI 1524

Cat. K55240 **$34.95**

SLIDE CROSS-FADER

Want to put on really professional slide show? This slide cross-fader can provide smooth dissolves from one projector to another, initiate slide changing automatically from an in-built varialbe timer, and synchronise slide changes to pre-recorded commentary or music on a tape recorder. All this at a cost far less than comparable commercial units. (EA Nov.'81) 81SS11

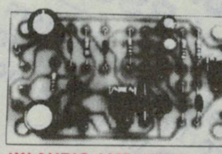
Cat. K81110 **$89.00**



HEADPHONE AMPLIFIER

PRACTICE WITHOUT ANNOYING THE FAMILY!
If you play any type of electronic instrument,this headphone amplifier will surely interest you. It will let you practice for hours without upsetting the household,or you can use it to monitor your own instrument in the midst of a rowdy jam session. (EA Feb.'84) 83MA11

Cat. K84111 **$29.95**



1W AUDIO AMPLIFIER

A low-cost general-purpose,1 watt audio amplifier, suitable for increasing your computers audio level, etc. (EA Nov.'84)

Cat. K84111 **$9.95**

COMPUTER DRIVEN RADIO-TELETYPE TRANSCEIVER

Here's what you've been asking for, a full trasmit-receive system for computer driven radio teletype station. The software provides all the latest "whizz-bangs" like split-screen operation, automatically repeating test message, printer output and more. The hardware uses tried and proven techniques. While designed to team with the popular Microbee, tips are avaialble on interfacing the unit to other computers. (ETI Nov.'84) ETI 755)

Cat. K47550 **$139**

PREAMP FOR PAGING AMP

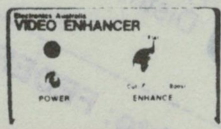
A versatile preamp with separate bass, treble and volume. (ETI 1421)

Cat. K54210 **$24.95**

15V DUAL POWER SUPPLY

This simple project is suitable for most projects requiring a dual voltage. (ETI 581, June '76)

Cat. K45810 **$19.50**



VIDEO ENHANCER

100's SOLD
Like tone controls in a hi-fi amplifier, touch up the signal with this Video Enhancer. (EA Oct.'83) 83VE10

Cat. K83100 **$39.50**

MICROBEE SERIAL-TO-PARALLEL INTERFACE

Most microcomputers worth owning have an 'RS232' connector, or port, through which serial communications (input/output) is conducted. It is a convention that, for listing on a printer, the BASIC LLIST or LPRINT command assumes a printer is connected to the RS232 port. Problem is, serial interface printers are more expensive than parallel 'Centronics' interface printers . Save money by building this interface. (ETI Jan.'84) ETI 675

Cat. K46750 **$59.50**

RADIOTELETYPE CONVERTER FOR THE MICROBEE

Have your computer print the latest news from the international shortwave news service. Just hook up this project between your short wave receivers audio output and the MicroBee parallel port. A simple bit of software does the decoding. Can be hooked up to other computers too. (ETI Apr.'83)

Cat. K47330 **$19.95**

FAIR DINKUM RS232 FOR MICROBEE

The Microbee, among other home computers, has a 'sort of' RS232 port in that it doesn't implement negative-going portion of its ouput signal (TxD). Most peripherals with an RS232 input can cope with that, but inevitably, there are those that can't. This project fixes that. (ETI 676, ETI FEB '84)

Cat. K46760 **$59.50**

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Have your voice transformed into that of the sinister sounding Cylons. Great fun and scary! (EA Jan '81)

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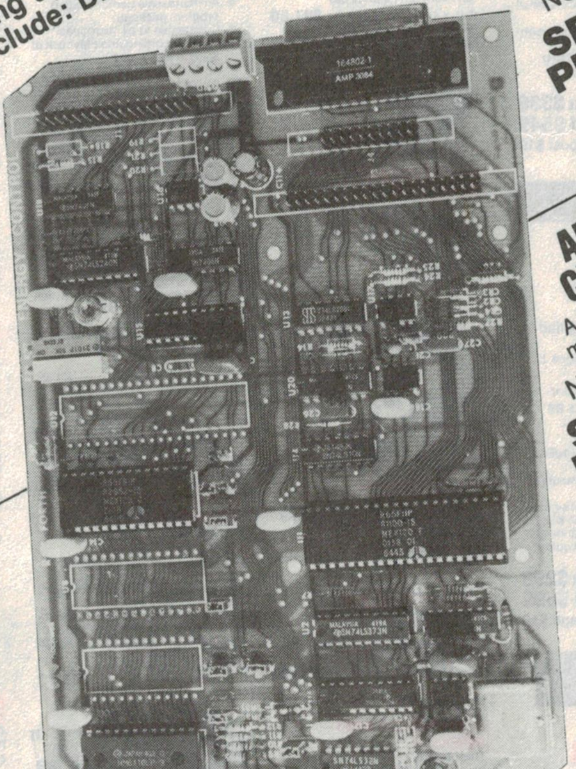
Exclusive to eti Readers . . . from energy CONTROL

Low Cost FORTH DEVELOPMENT SYSTEM

Forth is a simple, no-nonsense computer language that's ideal for control applications. Energy Control and ETI have got together to offer this low cost RSC Forth Development System.

The RSC Forth Development System has been designed for the computer hacker who wants to get into Forth without giving up too much time and money. Standard features of the system firmware include: Disk interface, Centronics printer port and EPROM capability.



STARTER KIT

(i) Low cost development system mains DS board, plated through holes and silkscreen as seen on page 72 of ETI May, 1985.
(ii) The complete RSC Forth manual.
(iii) R65F11 Forth Kernel and Microcomputer.
(iv) R65FR1 Development ROM.
(v) Programmed Bipolar PROM.

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UPGRADE KIT — 1

(i) DSDD 40 track disk drive.
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A silk-screened board for the R65F12 microcontroller.

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INTELLIGENT MODEM

This is the first of our series of articles on the ETI-684 1200/75 modem to detail the construction of the project. We have chosen to concentrate on the power supply this month, and will publish the rest of the circuit plus the software next month.

S.K. Hui **Part 3**

BECAUSE THE MODEM has auto answer and auto dial facilities it is designed to be left unattended for long periods without soaking up too much power. The result is that it needs a power supply with sufficient intelligence to realise when it's required and when not. Other considerations have influenced the design as well, notably that modems must meet stringent specifications from Telecom if they are to be approved. Fundamentally, these insist that it should be physically impossible for mains power to interfere with the Telecom lines. Another extremely important consideration is price, or lack of.

We believe we have met all these criteria with this power supply. For a start, it is extremely safe. The transformer is physically shielded from the rest of the power supply board, and the entire thing is encased in a box, separate from the main modem board. Output from the box to the board is strictly at TTL levels: +5, −5 and standby +5 volts are the only outputs.

Apart from the logic circuits the design is simplicity itself, and should represent no great challenge to even the most impecunious of you. It consists of a transformer, regulator and some smoothing caps all laid out in the usual fashion. To provide the special control needed, there are three ICs and a relay, which connect the power to the modem when required.

Logic

The power supply wakes up in the standby mode. A red LED flashes, and +5 volts is provided on the STBY line. This drives a few volatile memory circuits in the main board. Otherwise the supply is completely shut down, and the power supply leads are completely open circuited by a relay.

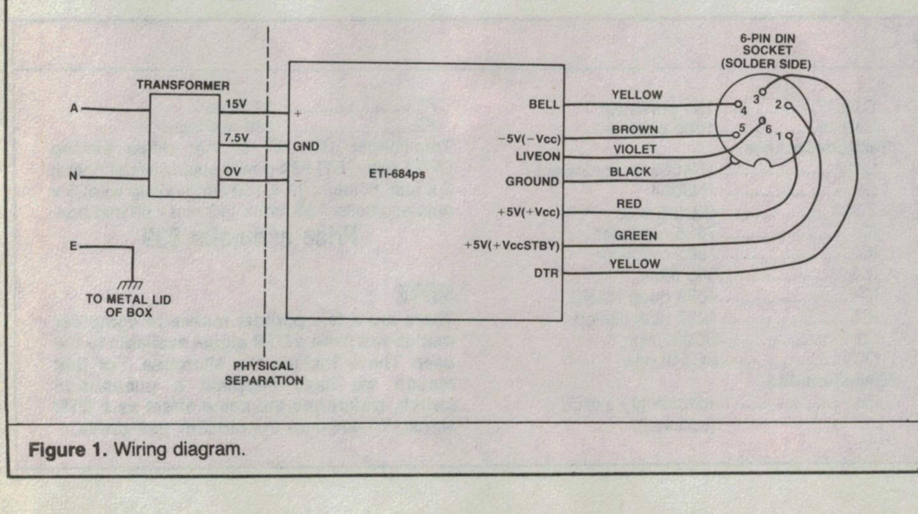
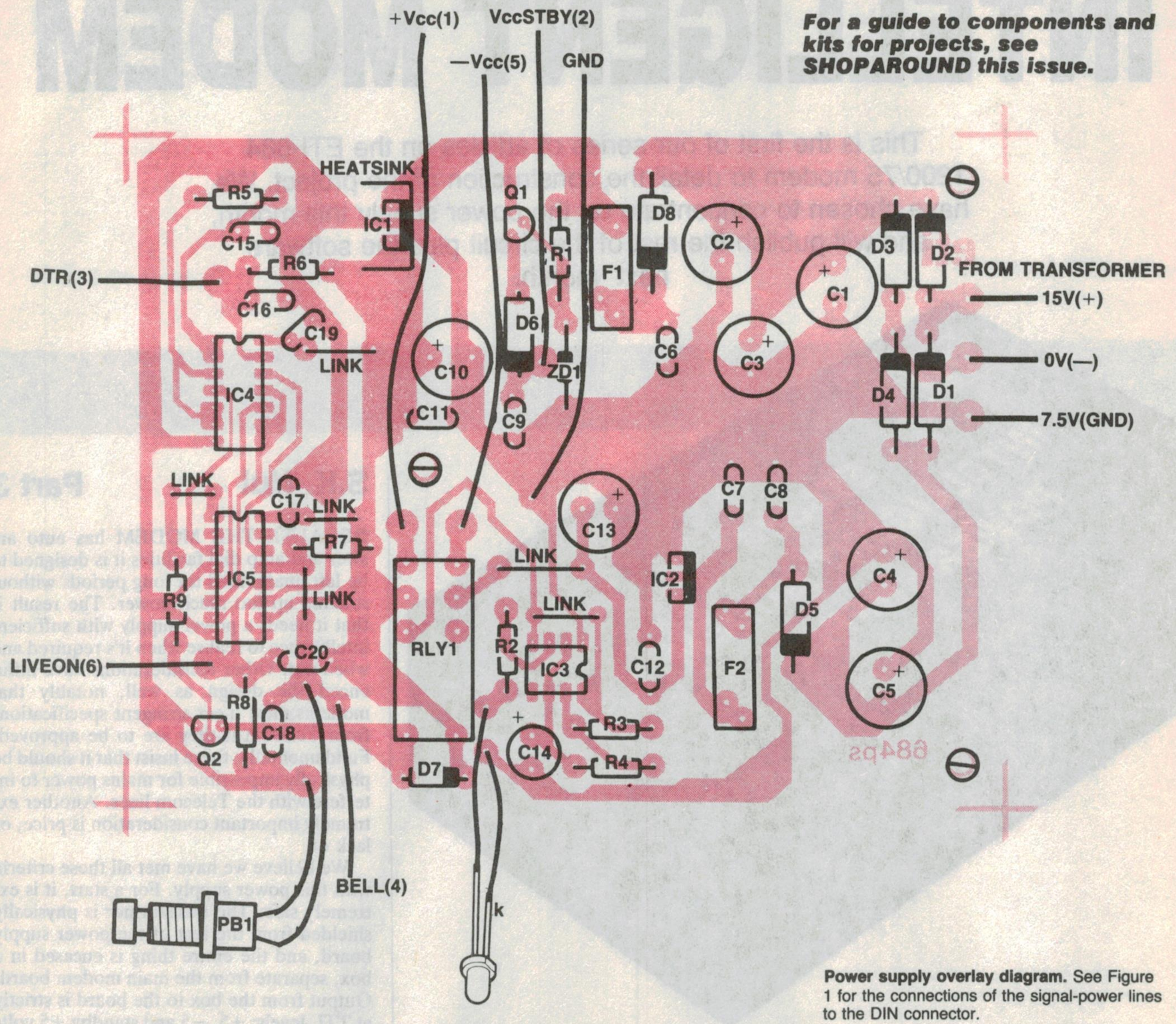


Figure 1. Wiring diagram.

For a guide to components and kits for projects, see SHOPAROUND this issue.



Power supply overlay diagram. See Figure 1 for the connections of the signal-power lines to the DIN connector.

PARTS LIST — ETI-684 Power Supply

Resistors .... all ¼ W, 5%
- R1 .... 3k9
- R2 .... 180R
- R3 .... 10k
- R4 .... 100k
- R5 .... 47k
- R6,7 .... 8k2
- R8 .... 4k7
- R9 .... 2k7

Capacitors
- C1,2,3,4,5 .... 1000µ electro, 25 V or higher
- C6,7,8,9,11, 12,20 .... 68n greencap
- C10,13 .... 470µ electro
- C14 .... 10µ electro
- C15,17,19 .... 15n greencap
- C16,18 .... 100p ceramic

Semiconductors
- D1-7 .... 1N4007 or equivalent
- D8 .... 1N5004
- ZD1 .... BZX85 6V2
- IC1 .... 7805 regulator
- IC2 .... 7905 regulator
- IC3 .... 555 timer
- IC4 .... 4093 quad NAND
- IC5 .... 4027 dual flipflop
- Q1 .... BC337 npn
- Q2 .... BC549 npn

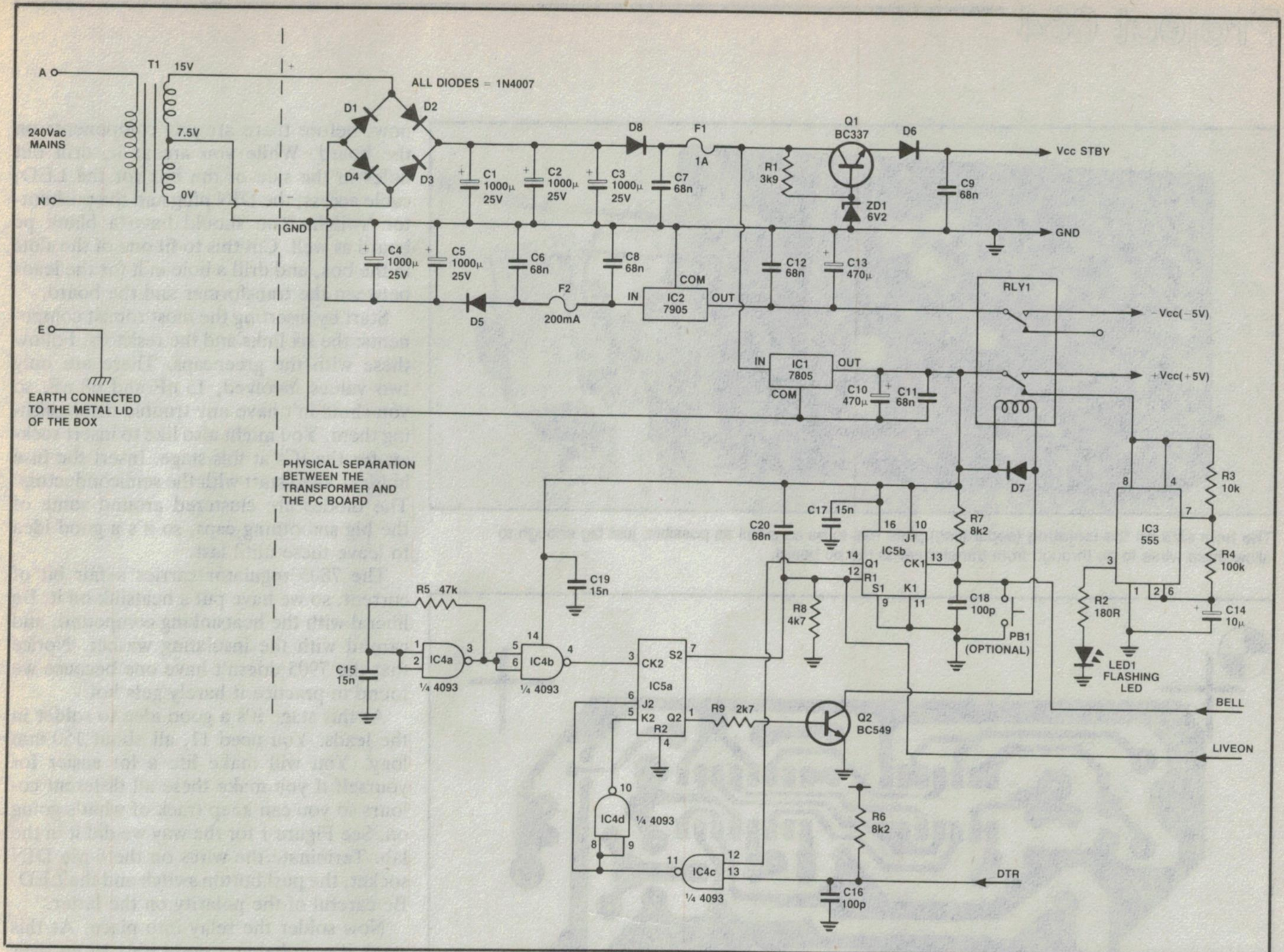
Miscellaneous
- PB1 .... momentary switch (optional)
- F1 .... 1A fuse
- F2 .... 200 mA fuse

Transformer 15 V CT at 1 A; single winding DPST relay; ETI-684 power supply circuit board; 2 x fuse holders; 12 x 150 mm hookup wire; 5 x nuts and bolts; 196 mm x 113 mm x 60 mm box.

Price estimate: $39

NOTE

There are a few popular makes of computer that do not have a DTR signal available to the user. These include the Microbee. For that reason we have supplied a pushbutton switch, which has the same effect as a DTR signal. To wake up the modem, just press.



HOW IT WORKS — ETI-684

Power is applied via the transformer, T1, and rectified by the diodes, D1 to D4. Smoothing and further rectification is supplied by C1 to C8 and the two diodes, D5 and D8. The dc level here will be about ±7.5 Vdc, which is applied to the regulators and transformed into 5 Vdc positive and negative. This is then connected to the modem board via the relay, RLY1.

The rest of the circuit is taken up with controlling the operation of the relay. The relay is driven by Q2, which is protected against back emf by D7. IC5a controls the operation of the transistor. IC5a is a JK master-slave flipflop, clocked by an oscillator made up of two NAND gates IC4a and IC4b. Output is determined by the condition of its two inputs, J and K, plus the set and reset pins.

Operation is as follows: as long as R2 is low, which it always is, Q2 will go high whenever S2 is taken high. S2 is tied to ground via R8, but may be pulled up by the LIVEON input. This is the override which allows the modem to control its own power supply.

Otherwise the state of Q2 will be controlled by the operation of J2 and K2. Because these two are connected so that K2 is always the inverse of J2, whenever the J2 input is high, Q2 will be high, and when it's low, Q2 will be low. This input is derived from IC4c, functioning as a NAND gate. Thus, we require that either or both its inputs be low to trigger the flipflop. One side of the gate is connected to $\overline{Q1}$ of IC5b, which is in standby mode, with its $\overline{Q1}$ high. However, the other side of the NAND input, pin 13, is held high by R6, except when a negative going signal from the DTR input pulls it down. Thus, the relay will trigger when DTR goes low, and reset when it is released, (unless it is held up by the LIVEON signal).

The other way of triggering flipflop IC5a is by making the $\overline{Q1}$ of IC5b low. This will happen whenever a positive going signal is applied to the clock input, which occurs in the presence of the first pulse of the Bell tone, or on the release of the pushbutton switch. Notice that IC5b will hold itself up irrespective of future trigger pulses on the clock. The only way it can be reset is by activating its reset line, which is connected to the LIVEON input.

Both DTR and BELL are held at their correct levels by networks consisting of 8.2k resistors and 100 pF capacitors. The LIVEON input is tied to ground via R8.

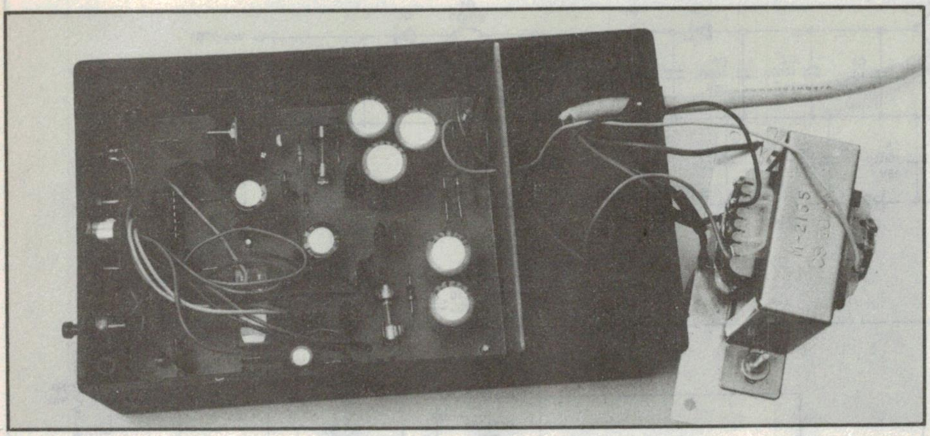
The LED is pulsed by a 555 set up in traditional fashion with a network composed of R3, R4 and C14, which sets up its oscillation frequency. R2 functions as a current limiter on the LED.

There are three inputs into the system. A DTR line (data terminal ready), indicates to the power supply that the terminal operator wishes to make an outward call. When this goes active (is pulled low), the power supply provides full power to the modem. In actual fact the DTR signal is derived from an RS232 receiver chip on the modem board, powered by the STBY line. Alternatively, an inward call may be detected by the presence of Bell current. This signal is provided by another chip on the modem board that is kept active by the STBY line. Ring tone is optically coupled to the BELL line, and conditioned to TTL levels.

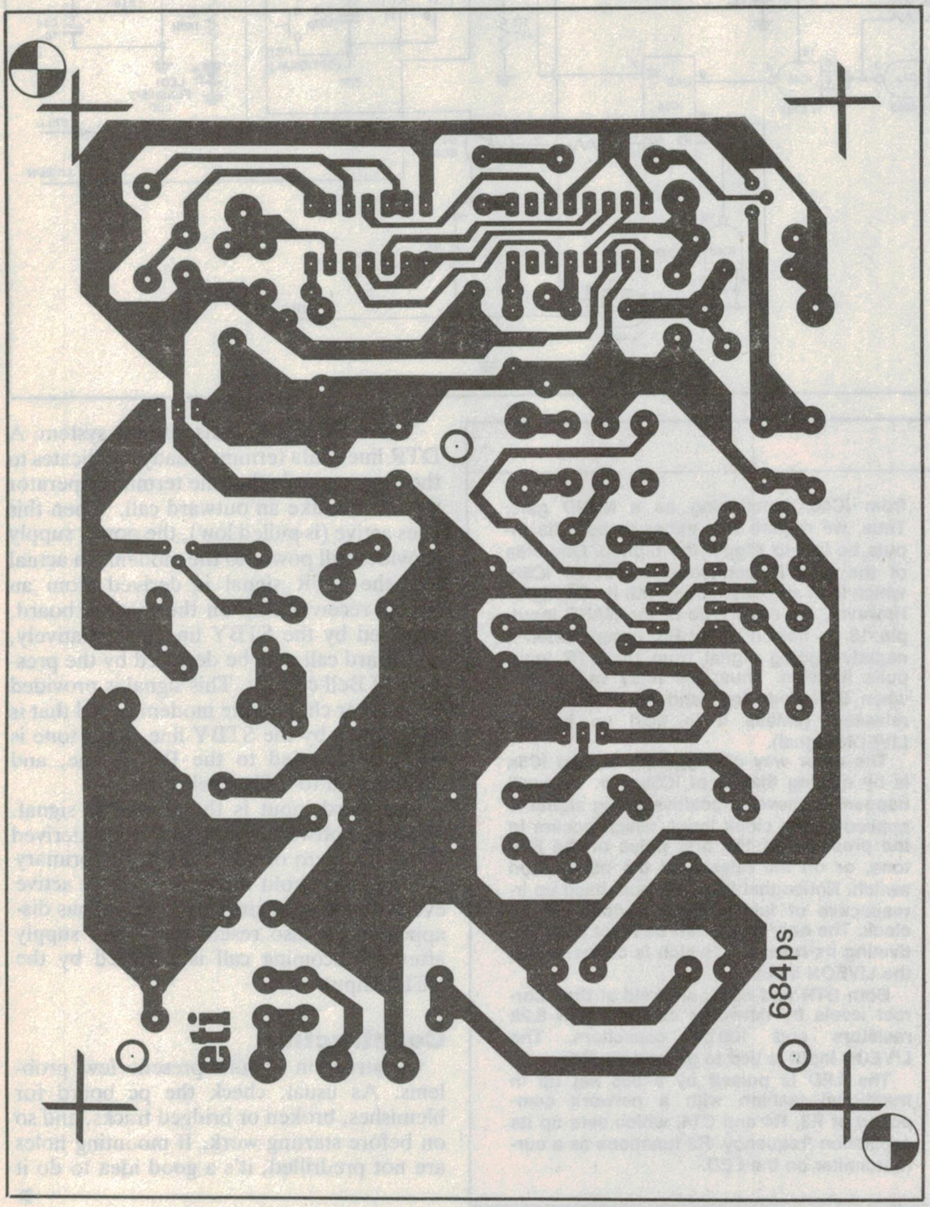
The third input is the LIVEON signal. This is a software controlled signal derived from the micro on the modem. Its primary function is to hold the power supply active even when the original DTR signal has disappeared. It also resets the power supply after an incoming call is detected by the BELL input.

Construction

Construction should present few problems. As usual, check the pc board for blemishes, broken or bridged tracks, and so on before starting work. If mounting holes are not predrilled, it's a good idea to do it ▶



The hole size on the isolating (separating) plate has to be as small as possible, just big enough to allow three wires to go through from transformer to the pc board.



now, before there are any components on the board. While you are at it, drill out holes in the side of the box for the LED, cable access, the DIN plug and the pushbutton switch. You should have a blank pc board as well. Cut this to fit one of the slots in the box, and drill a hole in it for the leads between the transformer and the board.

Start by inserting the most robust components: the six links and the resistors. Follow these with the greencaps. There are only two values involved, 15 nF and 68 nF, so you shouldn't have any trouble distinguishing them. You might also like to insert sockets for the ICs at this stage. Insert the fuse holders, then start with the semiconductors. The diodes are clustered around some of the big smoothing caps, so it's a good idea to leave these until last.

The 7805 regulator carries a fair bit of current, so we have put a heatsink on it. Be liberal with the heatsinking compound, and careful with the insulating washer. Notice that the 7905 doesn't have one because we found in practice it barely gets hot.

At this stage it's a good idea to solder in the leads. You need 11, all about 150 mm long. You will make life a lot easier for yourself if you make these all different colours so you can keep track of what's going on. See Figure 1 for the way we did it in the lab. Terminate the wires on the 6-pin DIN socket, the pushbutton switch and the LED. Be careful of the polarity on the latter.

Now solder the relay into place. At this stage it's probably a good idea to go over your work with a fine toothed comb. Check for solder bridges, dry joints, and above all, the wrong polarity in any components. It's also a good idea to make sure that all the components are where they should be.

The assembled board is now ready to be inserted into the box. Push the power leads through the hole in the back of the pc board, then solder them on to the board and the transformer. Push the mains cable through the hole in the box and solder it on to the relevant lugs. Be very careful wiring up the transformer. When you've done this, bolt the transformer down on the metal lid on the box. Remember to secure the mains earth lead between the box and the transformer.

Finally, insert the LED, pushbutton switch and DIN plug into their holes in the side of the box, push the divider plate into the slot and the board down on to its mounting posts. Then screw down the lid and stick the Scotchcal label on the top of the box.

To allow good ventilation for the heatsink, small holes may be drilled on the walls of the box.

Testing

To test the unit, especially if you haven't got hold of the modem itself, the best solution is to wire up a DIN plug so that you

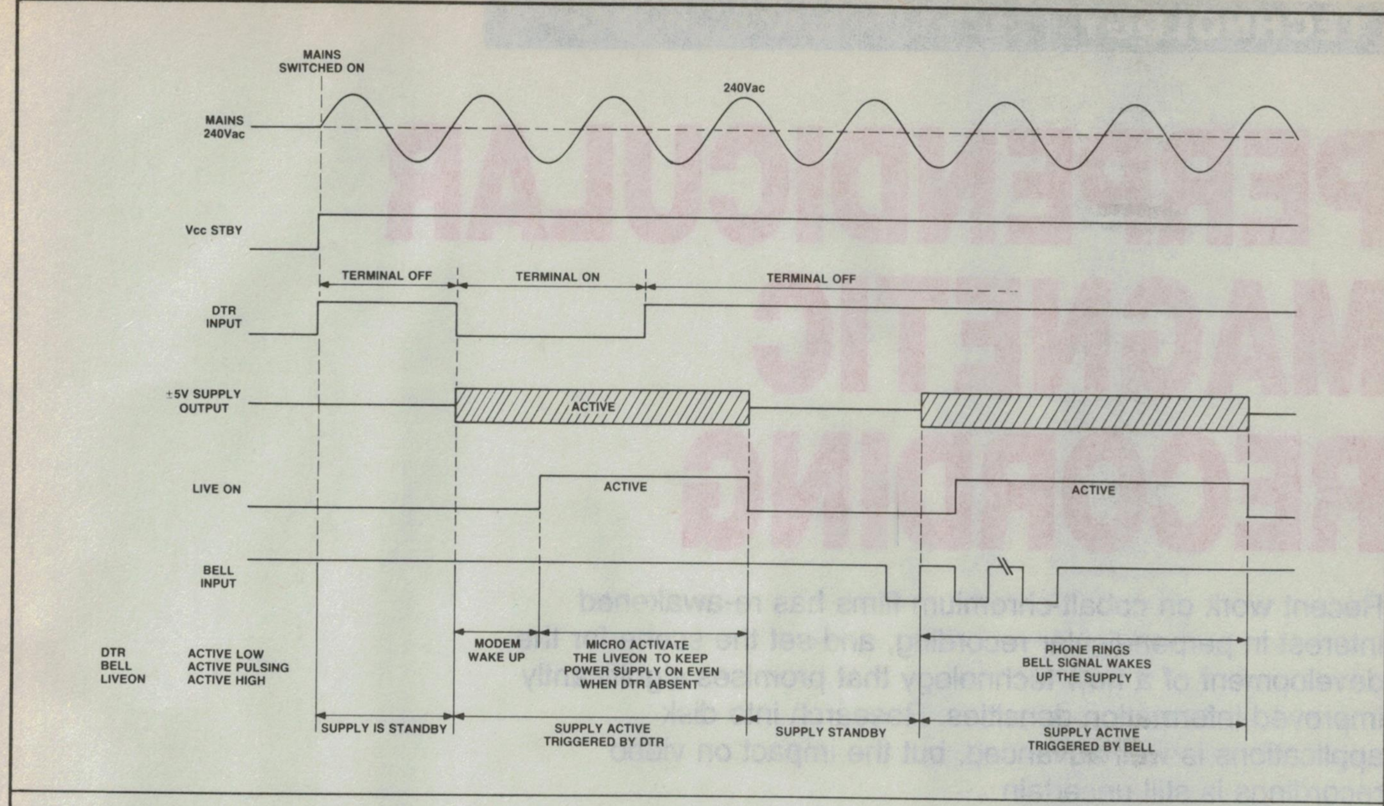


Figure 2. Signal relationships for controlling the power supply.

have access to all the control lines outside the box. Turn on and observe the LED flashing. If it doesn't, tap the LIVEON lead against the STBY. If this doesn't work at once then you have a problem. Switch off and start checking.

Assuming the LED is flashing you have a pretty good indication that the power supply has achieved standby mode. To confirm, probe pin 2 of the DIN socket. You should find 5 volts, and nothing anywhere else. Press the button. This should result in the relay clicking audibly. If you now probe pin 1 you should find +5 volts, and pin 5 should show −5 volts, in addition to the 5 volts on pin 2. Return to standby mode by tapping LIVEON against STBY, then the ground which is connected to the shield. Tap the BELL lead against either STBY or GND and the same thing should happen. Once again you will need to reset by using the STBY lead.

Short the DTR terminal, pin 3, to ground. The relay should click and the LED go out. Once again check for supply on the Vcc leads. As soon as you remove the short, the modem should return to standby.

Finally, confirm that LIVEON is working. When this is tied high the relay should be triggered, irrespective of the state of BELL or DTR. Check that nothing happens if these are shorted to either STBY or GND. When you release LIVEON the power supply should return to standby mode.

If all this works as it should, you have a fully working power supply. Now you just have to wait for the next issue. ●

Super safe power supply with an isolating plate dividing the box into two separate compartments: one for housing the transformer and the other for the pcb. Note that the 240 Vac cable enters the box at one end while the dc voltage outputs leave the box at the other via a DIN connector.

PERPENDICULAR MAGNETIC RECORDING

Recent work on cobalt-chromium films has re-awakened interest in perpendicular recording, and set the scene for the development of a new technology that promises significantly improved information densities. Research into disk applications is well advanced, but the impact on video recordings is still uncertain.

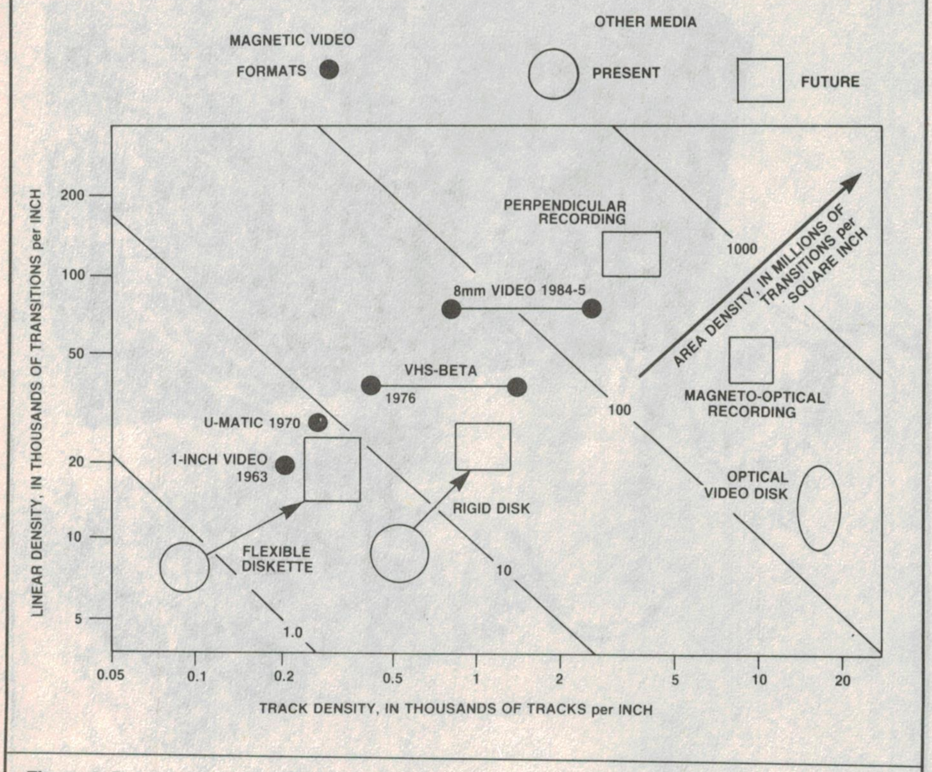


Figure 1. Density of information on the surface of various recording media. Area density is the product of linear density and track density. A 'transition' is either a magnetic reversal or the corresponding change in optical media.

PERPENDICULAR MAGNETIC recording is a relatively new technological procedure. As the name suggests, the direction of magnetization is predominately perpendicular to the plane of the tape or disk, and this innovation promises information densities significantly higher than those now used. New recording media and heads are being developed, and already impressive results can be demonstrated. However, just as in conventional magnetic recording, the head design and the proximity of the head to the recording surface remain factors of critical importance to high-density information storage.

The goal of any research and development in magnetic recording is, of course, to increase the information density stored on the surface of tapes and disks. An increased density can then be used by the video system designer to achieve various objectives including higher image resolution, a more compact physical format or the implementation of digital technology.

Information density in magnetic recording is related to the number of magnetic flux reversals, or transitions, per unit area of the tape or disk and also to the detected signal-to-noise ratio. We are concerned here only with the enhanced transition density and signal strength; minimizing noise is an additional matter which involves control of magnetic domain size and surface irregularities.

With conventional magnetic recording technology, magnetization directions lie predominately in the plane of the medium,

M. P. Sharrock
and D. P. Stubbs

whether tape or disk. Dramatic improvement in information density has come about largely through improved head design and the use of media with higher coercivities and smoother surfaces. Since the coercivity of a magnetic material is the field needed to reverse the direction of its magnetization, it is closely related to the stability of a high-density recording pattern. Surface smoothness determines how closely the recording or playback head can approach the magnetic surface. The 30 year achievement of increasing surface information density in various recording systems and volume storage density in video media is illustrated in Figures 1 and 2.

Advantages

An area of potential improvement in magnetic recording media is the magnetization intensity of materials. Most of the presently used media are of particulate construction, that is, they employ small discrete magnetic particles dispersed in a tough, flexible binder. The presence of the organic binder dilutes the magnetization of the recording material, reducing the available signal strength. Advanced media, now being developed, use continuous thin films of magnetic metal alloys to achieve higher magnetization intensity and also exceptionally smooth surfaces.

Hand-in-hand with the increased attention to continuous films has come a strong interest in perpendicular recording (also ▶

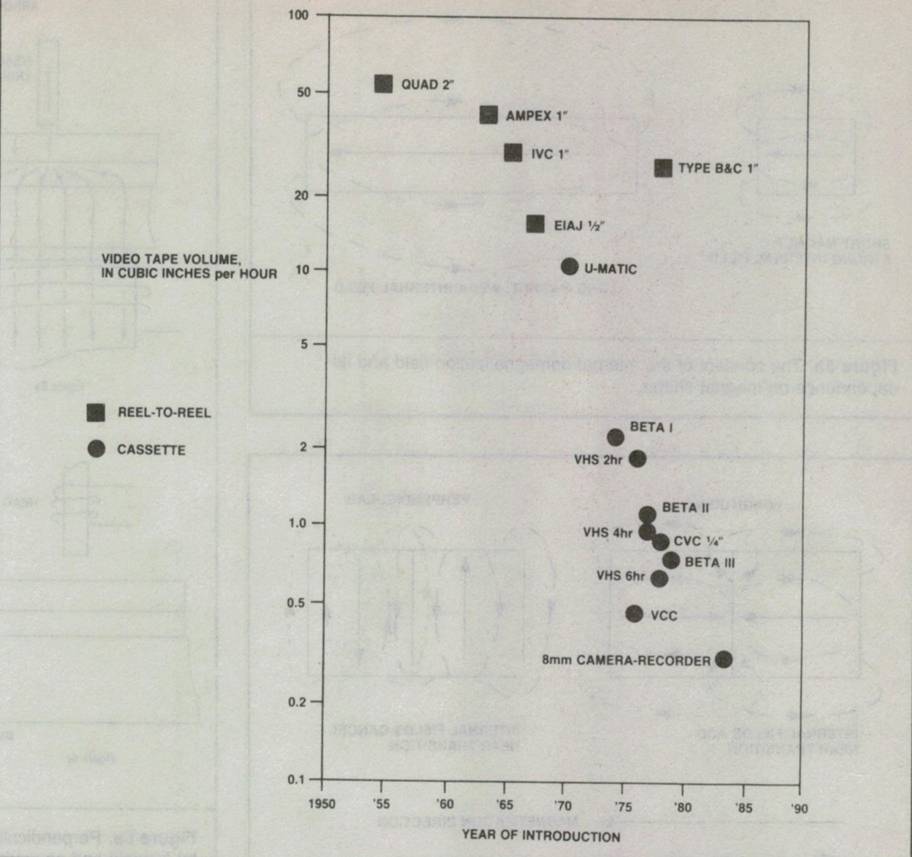


Figure 2. Volume storage density of video media, expressed in terms of tape volume per hour of playback plotted against year of introduction.

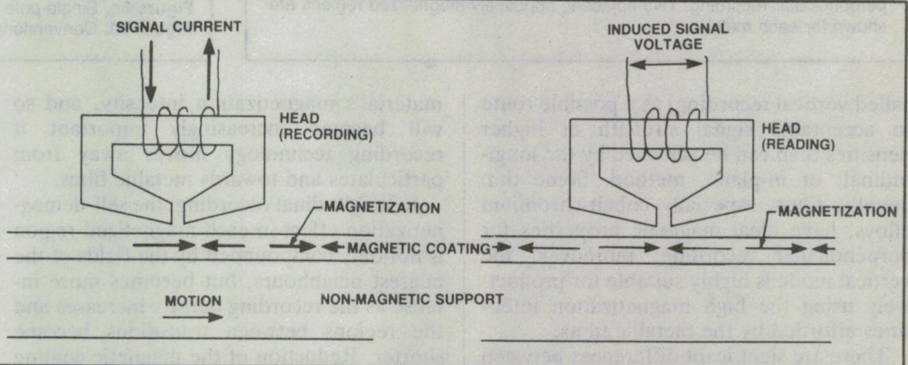


Figure 3. Schematic diagram of conventional, longitudinal magnetic recording.

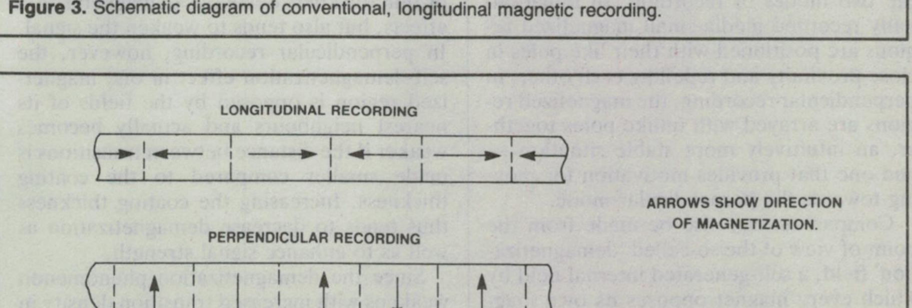


Figure 4. The geometries of longitudinal and perpendicular magnetic recording. For simplicity, only the magnetic coating is shown, without its support material.

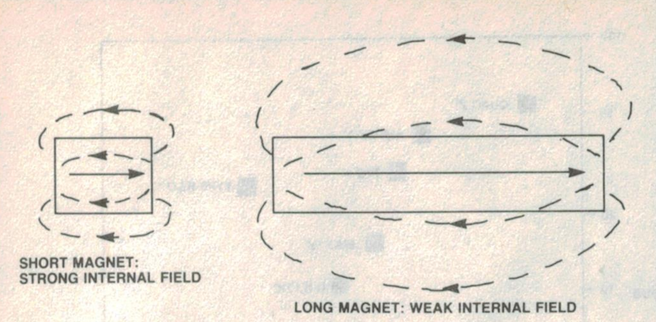


Figure 5a. The concept of the internal demagnetization field and its dependence on magnet shape.

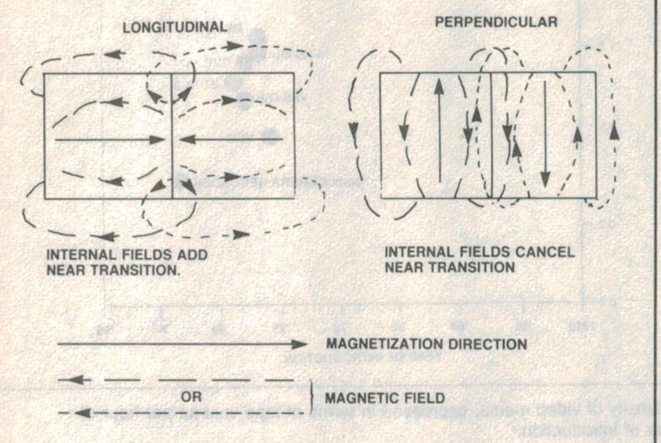


Figure 5b. The demagnetization fields in high-density longitudinal and perpendicular recording. Two adjacent, oppositely magnetized regions are shown for each method.

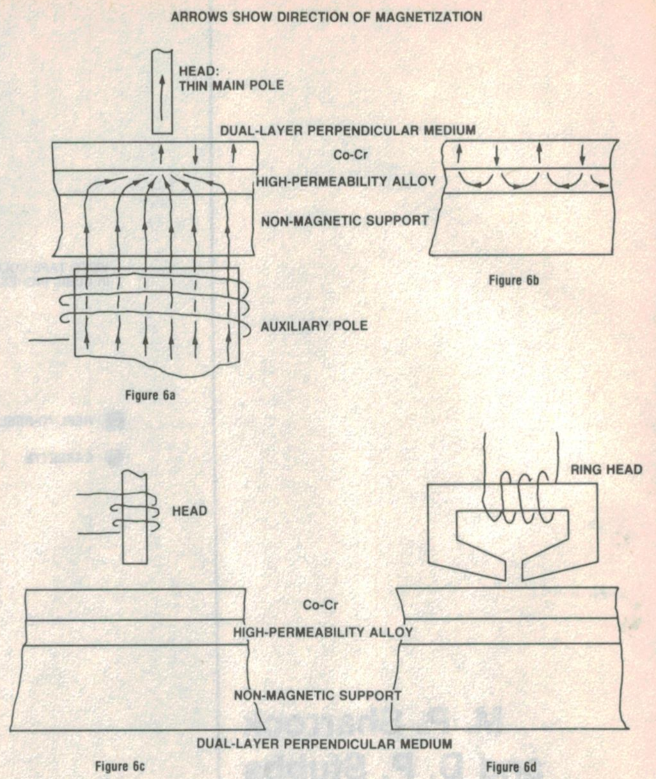


Figure 6a. Perpendicular recording head and dual-layer medium developed by Iwasaki and co-workers, in the recording process. The recording field is driven by the auxiliary pole (shown below) and concentrated by the thin main pole via the high-permeability layer of the medium.
Figure 6b. Dual-layer medium in the recorded state. The high-permeability underlayer adds additional stability to the magnetized regions by coupling the magnetization of oppositely polarized nearest neighbours.
Figure 6c. Single-pole head used with dual-layer perpendicular medium.
Figure 6d. Conventional ring head with dual-layer perpendicular medium.

called vertical recording) as a possible route to acceptable signal strength at higher densities than can be achieved by the longitudinal, or in-plane, method. Some thin metallic films, especially cobalt-chromium alloys, have ideal magnetic properties for perpendicular recording; moreover, the vertical mode is highly suitable for productively using the high magnetization intensities afforded by the metallic films.

There are significant differences between the two modes of recording. In longitudinally recorded media small magnetized regions are positioned with their like poles in close proximity and repelling each other; in perpendicular recording, the magnetized regions are arrayed with unlike poles together, an intuitively more stable situation — and one that provides motivation for moving towards the perpendicular mode.

Comparison can also be made from the point of view of the so-called 'demagnetization' field, a self-generated internal field by which every magnet opposes its own magnetization. This field depends upon the magnet's shape, becoming stronger if the magnet is made shorter along its direction of polarization. (See Figure 5.) The demagnetization field is proportional to the material's magnetization intensity, and so will become increasingly important if recording technology moves away from particulates and towards metallic films.

In longitudinal recording, the self-demagnetization effect in each magnetized region is not only compounded by the fields of the nearest neighbours, but becomes more intense as the recording density increases and the regions between transitions become shorter. Reduction of the magnetic coating or film thickness decreases demagnetization effects, but also tends to weaken the signal. In perpendicular recording, however, the self-demagnetization effect in one magnetized region is opposed by the fields of its nearest neighbours and actually becomes weaker if the distance between transitions is made smaller compared to the coating thickness. Increasing the coating thickness thus tends to decrease demagnetization as well as to enhance signal strength.

Since the demagnetization phenomenon weakens with increased transition density in the perpendicular recording mode, one might expect that conversely it could become highly unfavourable at relatively low densities, where the distance between transitions becomes large compared to the magnetic film thickness. This is true, but only at positions far from the transitions. The transitions themselves remain sharp and distinct and thus useful in systems of interest for video recording, where the information is contained in the timing or frequency of transitions. Thus a large, useful bandwidth is available. If using a direct analogue format to record a low-frequency signal such as the audio track that accompanies video, a pulse-width modulation scheme can be used, which is comparable to ac-bias in conventional recording.

Developments

Perpendicular recording was first proposed and discussed decades ago but the recent intense development began with the work of Iwasaki and co-workers on cobalt-chromium films. This group also pioneered the use of a high permeability metal film beneath the Co-Cr layer; the composite structure provides magnetic flux linkage, which reduces demagnetization and enhances the effectiveness of the special head used. Numerous other laboratories have since become active in developing Co-Cr media, both with and without the underlayer, and a variety of head designs have been used.

Figure 6 shows the double-sided head and the dual-layer medium developed by Iwasaki and co-workers (Figures 6a and 6b), and a simpler perpendicular head (Figure 6c), less efficient than the Iwasaki configuration, but which requires access from only one side of the tape or disk. A conventional ring head (Figure 6d) can also be used with a perpendicular medium. This combination has been found effective in both theoretical modelling and experiment, and has been incorporated into a practical flexible-disk system.

Although the ring head is a very sensitive device for reading signals, questions have been raised concerning its effectiveness in recording truly perpendicular magnetization patterns. The use of two separate heads, a single perpendicular pole for recording and a ring head for reading, has been found advantageous. This combines the perpendicular recording abilities of the single pole with the reading sensitivity of the ring, and the arrangement gives a high output amplitude requiring access from only one side of the recording medium.

If one head is to be used for both recording and reading, then the ring head has a number of advantages. It apparently offers adequate recording performance, and when made with a very small gap has good reading sensitivity up to very high densities. The technology of ring head design and manufacture is well established.

Current materials research for perpendicular recording involves the use of continuous thin films other than Co-Cr as well as barium ferrite particles. The latter are dispersed in a binder and coated on a flexible backing as in conventional videotapes. They thus may have some economic advantages over continuous metal films, which are made by plating, sputtering, or vapour deposition. Efforts are also being made to produce recording tapes that have needle-shaped magnetic particles similar to those used in conventional audio and video tapes, oriented perpendicular to the surface.

Current directions

Proponents of perpendicular recording on Co-Cr claim that it not only has a relative freedom from demagnetization effects, but also a magnetic microstructure that lends itself to sharp, well-defined magnetic transitions. Some longitudinally magnetized metal films, in contrast, have been observed to form jagged, 'saw-tooth' transitions between regions of opposite magnetizations (see Figure 7); this characteristic, if applicable to longitudinal media generally would tend to limit transition sharpness and thus the achievable recording density.

Despite the importance of demagnetization phenomena and magnetic microstructure, a major limitation on magnetic recording density is the inherent resolution with which the head can record or read. This resolution necessarily deteriorates with increased spacing between the head and the medium, but it is also affected by the head design. Head-to-medium spacing, which depends upon the smoothness of the recording surface, is a consideration that is common to perpendicular and longitudinal recording and may well prove to be the ultimate limiting factor in both.

But while all methods of magnetic recording operate under limitations imposed by head-to-surface spacing, they need not be equally sensitive to this aspect. There is some evidence that the use of a ring head with a perpendicular medium is subject to a stronger dependence upon spacing than that encountered with other head-medium combinations. The extra sensitivity to spacing appears to be involved in the recording, as opposed to reading, process. These findings do not imply that the ring head is undesirable for perpendicular recording, but they do emphasize the importance of the spacing phenomena and the need for further research in head design.

Research and development work on Co-Cr films, as well as other advanced recording materials, was begun at 3M some years ago. Figure 8a shows a plot of output amplitude v transition density for a Co-Cr coated flexible disk. It was recorded and read with a conventional ferrite ring head of the type used in VHS video cassette recorder. Performance is clearly superior to that of a disk coated with typical particulate material designed for VHS cassette tape, with respect to both the maximum output and the rate at ▶

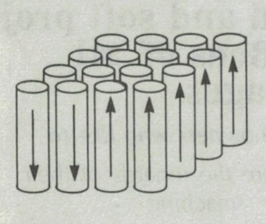


Figure 7a. Idealized diagram of magnetic domains in Co-Cr film, showing a sharp transition between upward and downward magnetization.

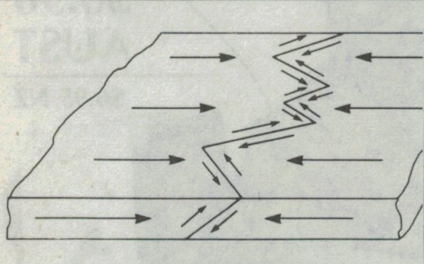


Figure 7b. Simplified drawing of 'saw-tooth' magnetic transition in longitudinally oriented film. Arrows show directions of magnetization.

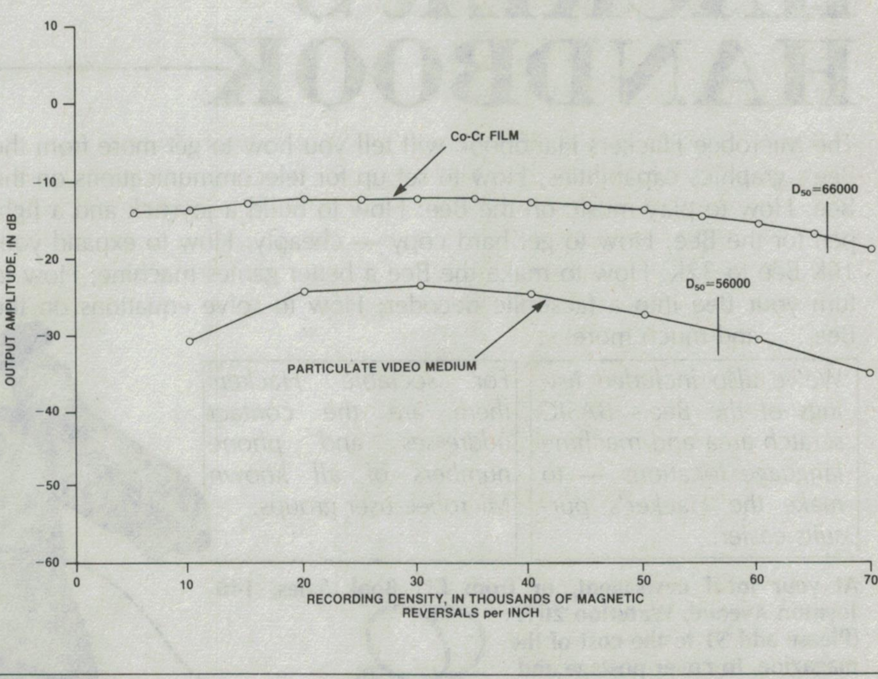


Figure 8a. Plot of output amplitude v linear transition density for a dual-layer Co-Cr sputtered flexible disk recorded with conventional ferrite ring head with large gap (18μ").

which the output falls off with increasing density. Figure 8b shows results for the same media with an advanced video head of very small gap but still of conventional ring construction.

So what of the future?

The competition between the various modes of recording is to some extent a competition between the practical characteristics of the materials that make them possible. These characteristics include wear properties, chemical stability, and the economics of manufacturing. Also important are freedom from information 'drop-outs', due to defects, and noise properties, which depend upon surface smoothness and magnetization structure. Almost certainly, no one material will be found best for all applications.

The advanced materials designed for perpendicular magnetization have achieved impressive recording densities in the laboratory and are now moving into practical applications. The first will apparently be in the area of disks for digital data. However, only further development and extensive testing in the field will be able to determine the ultimate impact of materials such as Co-Cr upon video recording. ●

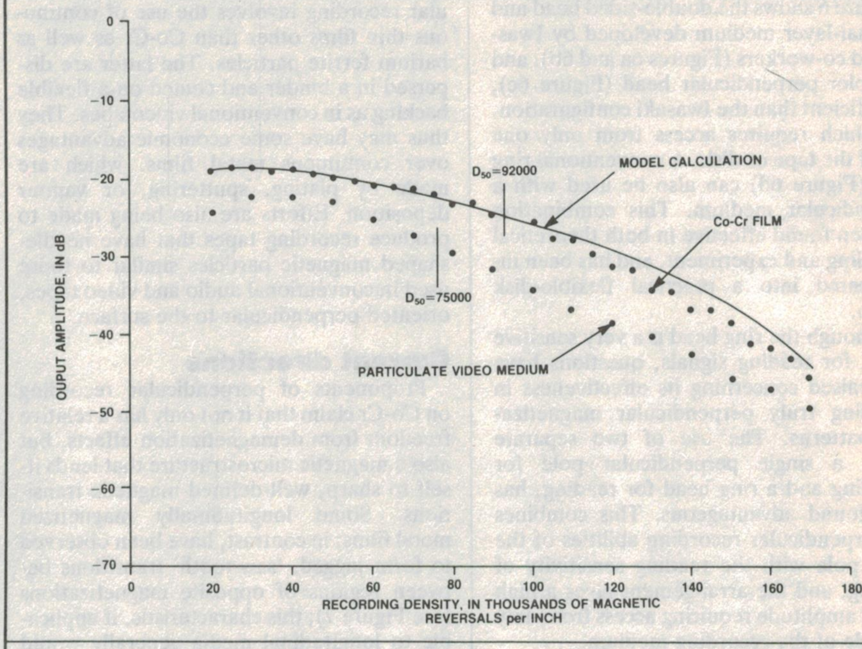


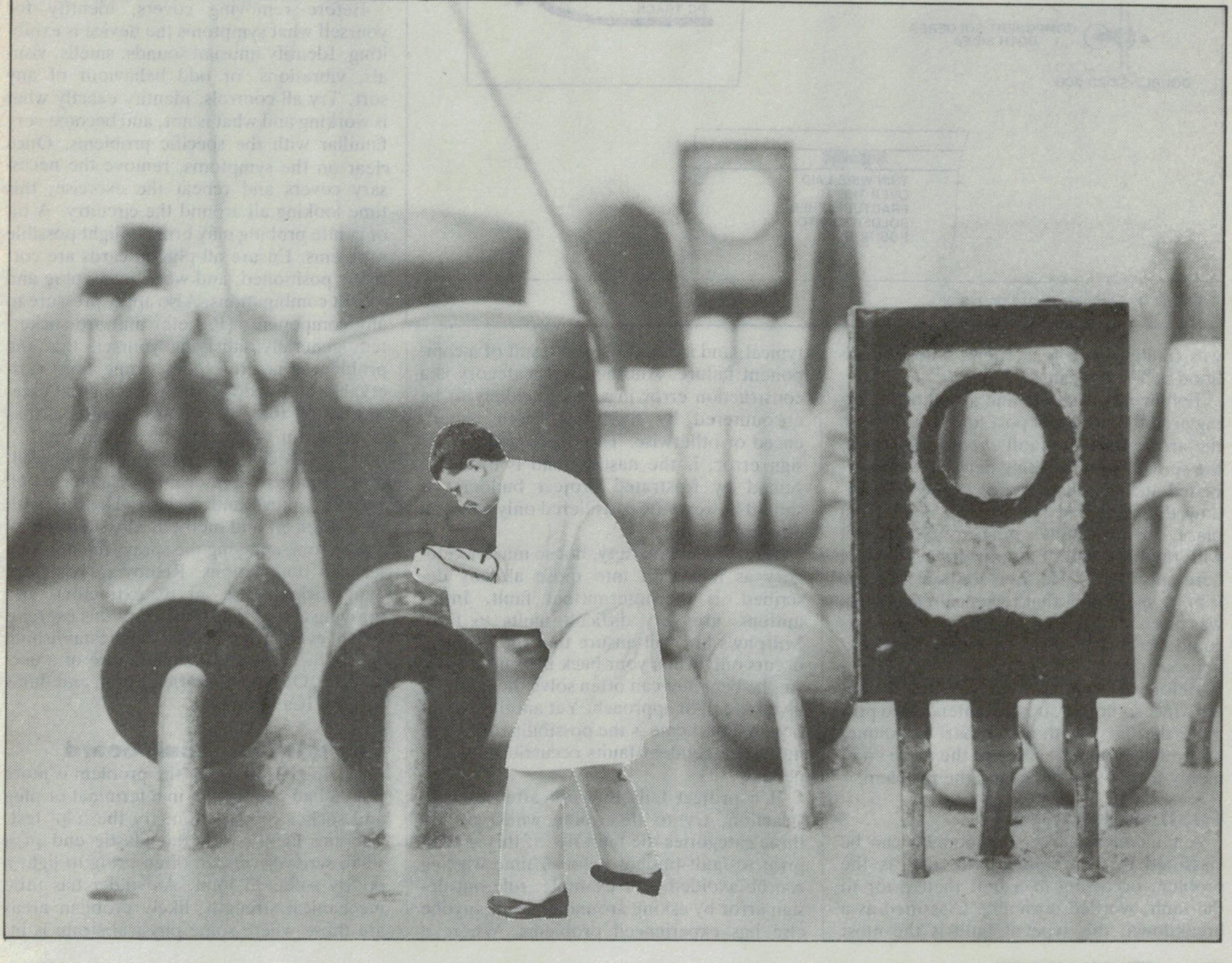
Figure 8b. Plot of output amplitude v recording density for the same medium as Figure 8a, with an advanced video head with a small gap (10.5μ").

FINDING THOSE FAULTS

Peter Phillips

Building a project is often the easiest part; getting it going is where the fun really begins. Fault finding is like trying to solve a murder mystery, clues abound, but the 'red herrings' confuse the issue. However, with a little perseverance and 'knowhow' many faults can be traced without needing expensive equipment and a high technical knowledge. Too good to be true? Read on, and find out the things the text books don't tell you!

BEFORE DESCRIBING FAULT finding techniques, a short but true story is appropriate to illustrate an aspect of servicing that often goes unmentioned. The author, who claims a good grasp of electronics, recently agonised over a fault in a popular model TV set. After a week of fruitless searching using sophisticated test equipment, circuit manuals, text books and copious head scratching, a painful decision was made. On the pretext of inquiring about his health, a phone call ▶



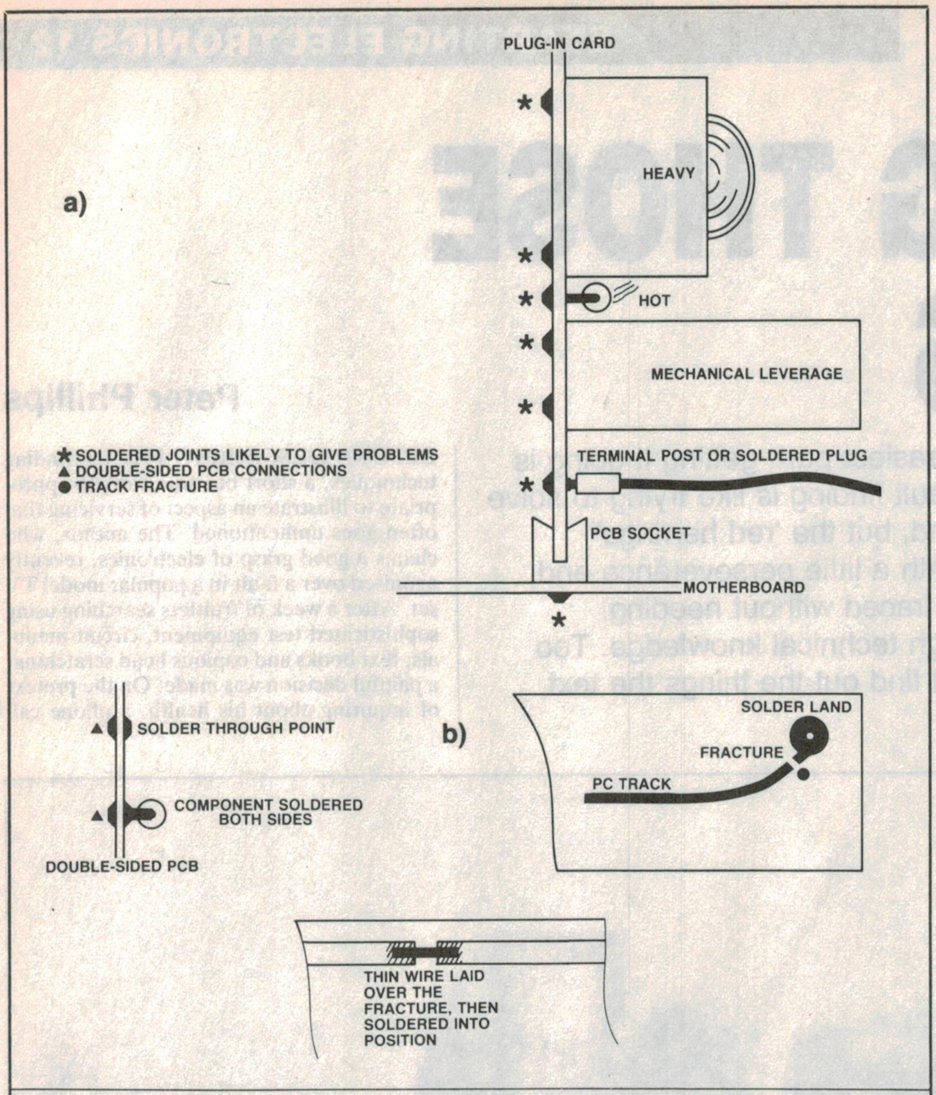


Figure 1. Some pc board problems.

was finally made to a friend whose livelihood is TV servicing.

Following his advice and a spot of soldering around a terminal post totally remote to the area where the fault *should have been,* the set was soon working perfectly. Embarrassed and humbled, the next question was how the fault had been found in the first place. "By carefully going around the set with the back end of a screwdriver, tapping here and there." He then continued to rub it in by suggesting that technical knowledge was often a hindrance, and that many faults could be found using the 'non textbook' approach.

Before the more technically minded readers wince in horror, it is not intended to promote the 'hit it with a hammer' technique, but rather to impart some of the more commonly used ploys in tracing the problem.

Fault categories

A fault in a piece of equipment can be classified in three ways. The first is the problem occurring in a unit that, prior to the fault, worked normally. Classified as a breakdown, this type of fault is the most typical, and is generally the result of a component failure. Another fault category is a construction error in a circuit, likely to be encountered by hobbyists, both experienced or otherwise. The final type, the design error, is the nastiest and is often assumed by frustrated project builders. It should however be considered only when all else fails.

Another fault variety, not so much a category as it can fit into those already described, is the intermittent fault. Intermittents are very difficult faults to find; Murphy's law will ensure that the problem occurs only when your back is turned. Even so, the beginner can often solve these faults, given the right approach. Yet another variation on the theme is the possibility of two or more independent faults occurring simultaneously.

If a project fails to work after its construction, try to determine which of the three categories the fault fits. If this is done prior to fault finding, a lot of time wasting can be avoided. For example, rule out design error by asking around to see if anyone else has experienced problems. Where a category cannot be determined, assume the error is a constructional one, as it is unlikely the components are faulty if they were purchased new.

The breakdown

A fault in previously proven equipment will be in a component, a faulty connection, a printed circuit board or will be the result of an accident — such as a watering when the pot plant was attended to. The servicing approach should commence by examining the events surrounding the fault. If the appliance belongs to someone else, don't always take their story as gospel. Few people are truly objective in describing a fault, particularly if they are embarrassed about the circumstances. Dropping the thing down two flights of stairs is often described as "a minor bump". Details to establish include any previous history of the fault, other related problems, even weather conditions at the time. Like solving a crime, any information that can give a lead should be sought.

Before removing covers, identify for yourself what symptoms the device is exhibiting. Identify unusual sounds, smells, visuals, vibrations, or odd behaviour of any sort. Try all controls, identify exactly what is working and what is not, and become very familiar with the specific problems. Once clear on the symptoms, remove the necessary covers and repeat the exercise, this time looking all around the circuitry. A bit of gentle probing may bring to light possible problems. Ensure all plug-in cards are correctly positioned, and wobble any plug and socket combinations. Also apply pressure to any components (ICs etc) that are socketted, generally satisfying yourself that the problem is not the 'poor connection' variety. Naturally, do all of this with great care, turning off the power if any doubt exists as to safety for yourself or the equipment.

If the device is more than a few years old, it often pays to spray contact cleaner on all switches, plugs and sockets. Do this with the power off and methodically separate all connectors, applying the spray (the non-oily sort) to both unions. Removing ICs from their sockets (use an IC extractor), and spraying the sockets is a part of this exercise which even if unsuccessful in establishing the fault, constitutes maintenance of a useful type. Observe the orientation, and don't mix the ICs around.

The printed circuit board

Having ensured that the problem is more than a bad connection in a terminal or plug and socket combination, try the 'tap' test. Tapping lightly with the plastic end of a small screwdriver can often bring to light a poorly soldered joint. As solder has little mechanical strength, likely problem areas are those where some physical strain is in-

volved. Soldering in areas with heavy components, or where subject to heating, with pc mounted plugs or sockets should be examined carefully. Gently wobbling large components or terminal posts and observing the soldered joint can often identify a dry or broken connection. Badly soldered joints may not manifest themselves for a number of years, and are the cause of many problems. Figure 1(a) shows some of the 'classic' instances where soldered joints are likely to fail.

Flexing the board (gently) can identify possible problems with pc tracks or connection points. If the fault is apparently corrected by distorting the pcb, localise the area as much as possible, then go to work with a soldering iron and a magnifying glass. Double sided pcbs are more prone to soldering failures where no physical strain on the connection is involved compared to single sided boards. Careful resoldering of all connections in the suspect area often does wonders.

Breaks in pc tracks are not uncommon, particularly at the point where the track joins the solder land. Some servicemen, after having tried everything else, run solder over every pc track in the hope of fixing invisible fractures. Repairing a track fracture should be done by cleaning the track where soldering is to occur then overlaying a piece of wire across the break and soldering it into position. Figure 1(b) illustrates these points.

Locating faulty components

If the appliance has not responded to the 'prod and probe' test, then a component is probably the problem source. The simplest way to find out which one, is to replace each component, one by one, until the fault is encountered. This basic method is known as component 'jockeying', and is often the quickest way where the component count is small. Start with the plug-in components, usually the ICs, replacing one at a time those ICs you have replacements for. Sometimes two similar ICs on the board can be swapped, and the effect noted. Always observe the behaviour of the unit after each component change, and be continually on the lookout for clues.

As a basic rule, try all the active components first. If a replacement is not available, test each component as best as possible using the methods described further on in this article. Where there is a large number of components, an attempt should be made to identify the *area* containing the fault. Touching each component to determine its operating temperature can often identify either a faulty component or the problem area. A cold component, or one that is too hot may be the clue. Cold components usually indicate a lack of power to the section, overheating can suggest many things.

Sometimes the faulty section can be isolated using basic tests. If the equipment contains an audio amplifier, applying a signal to the volume control will help identify if the amplifier section is operating. This is done by touching the centre terminal of the volume control with the blade of a screwdriver held in contact with the fingers. Listen for hum or noise that only occurs when the signal is applied. If an output results, the problem is before the volume control. No output suggests a fault in the power supply, the amplifier or the speaker circuitry. Power supplies can be tested using a voltmeter, or even a test lamp. If heat is being generated within the power supply circuit it is probably working, but further tests should be conducted to confirm that all sections of the circuit are producing the required voltages.

Faults in active components

Active components generally break down more often than passive ones. As ICs are often in sockets, searching for a faulty chip is usually the best place to start. The quickest way to establish if an IC is faulty is to replace it, but it should be remembered that there might be more than one fault. So leave the new IC in the circuit even if the problem is not found, and go on to the next.

However, some faults, particularly those in the power supply, may have caused the demise of every on-board IC, and as fast as you replace them, the fault destroys them. To avoid burning out your entire stock of components try to test each IC as it is removed. This is often difficult, but is preferable to losing all your ICs. Trying each chip in another known piece of equipment can help find the faulty one, or at least prove that all the ICs are working.

Transistor replacement should follow the integrated circuit check, unless all the ICs happen to be soldered in. The idea is to test the easiest things first, and transistors are more easily replaced than ICs if sockets have not been used. Often a replacement transistor is unavailable, thus requiring the testing of each of the transistors. Generally transistors should be removed from the circuit for testing, as parallel components can give rise to incorrect readings. Figure 2 illustrates how to test a transistor using a multimeter. When using an analogue meter, set it to its low ohms range, and remember that the polarity of the leads is reversed for ohms measurement, that is, the black lead becomes the positive potential. A digital multimeter should be on the diode check setting, and its lead polarity not reversed.

If all the ICs and transistors appear to be working, and checks have shown no bad connections, pc track break or power supply problem, then the remaining components should be examined. Be wary of accidentally introducing more faults during component replacing, taking care not to bridge pcb tracks, or to put a component in the wrong way. Only deal with one device at a time to prevent mixing them around, and always test the unit after each component replacement.

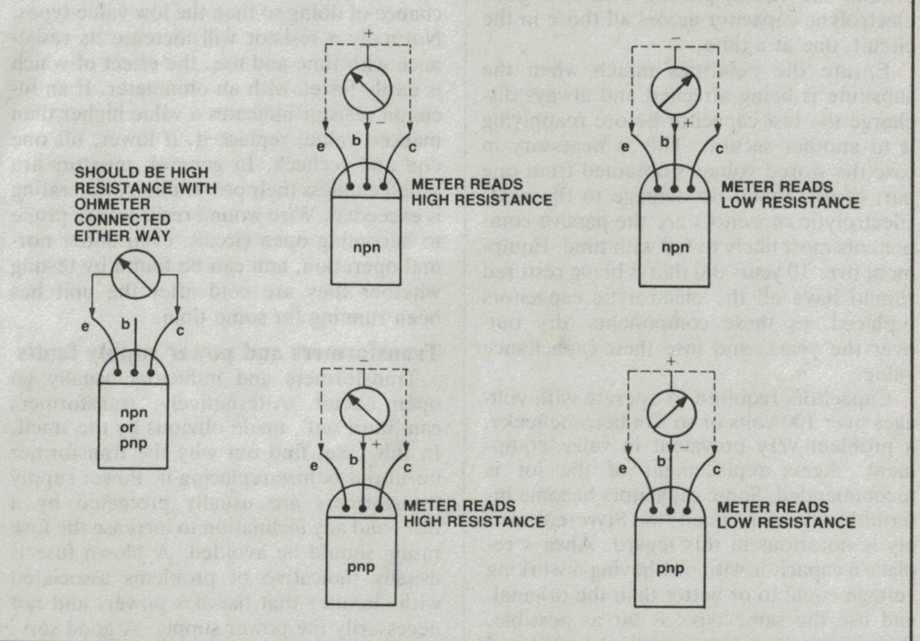


Figure 2. How to test a transistor using a multimeter. An analogue meter should be on its low ohms range. Note that the polarity of the meter will reverse; the black lead (—) becomes the positive potential. Digital meters should be on 'diode' test without reversed lead polarity.

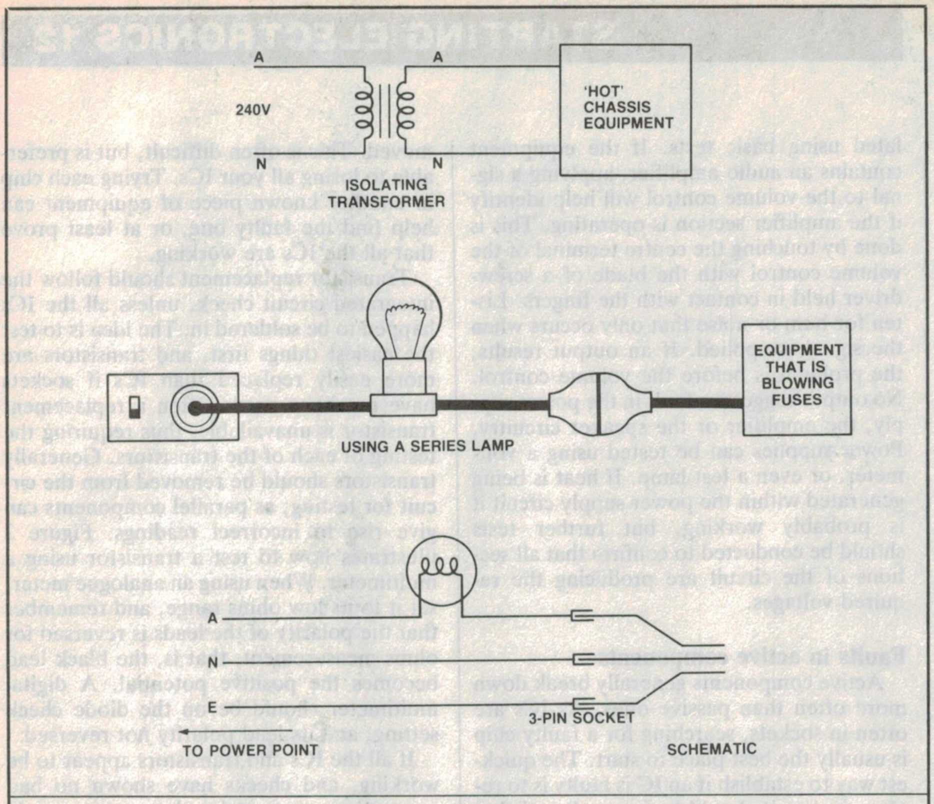


Figure 3. Mains power consideration. Lamp wattage should be equal to or greater than, up to two or three times, that of the equipment being serviced.

Faults in capacitors

A valuable hint on servicing equipment exhibiting peculiar faults is to test the capacitors associated with the power supply. If hum is present in a loudspeaker, a likely cause is a filter capacitor. Many a peculiar fault has been found by merely going around the circuit placing a known good electrolytic capacitor across all those in the circuit, one at a time.

Ensure the polarities match when the subsitute is being attached and always discharge the test capacitor before reapplying it to another section. This is necessary in case the stored voltages obtained from one part of the circuit do damage to the next. Electrolytic capacitors are the passive components most likely to fail with time. Equipment over 10 years old that is being restored should have all the electrolytic capacitors replaced, as these components 'dry out' over the years, and lose their capacitance value.

Capacitors required to operate with voltages over 100 volts or so can become leaky, a problem very prevalent in valve equipment. Again replacement of the lot is recommended. Some capacitors become intermittently open circuit; the Styroseal variety is notorious in this regard. Always replace a capacitor with one having a working voltage equal to or better than the original, and use the same type as far as possible. Paper capacitors can usually be replaced with polyestor types, but this is about the only exception.

Faults in resistors

Resistors, diodes, transformers, wiring and so on can all become faulty. But the possibility of this is less than for those components already discussed, meaning these items are best checked last. Resistors, particularly old style types can change their value; high value resistors have a greater chance of doing so than the low value types. Normally a resistor will increase its resistance with time and use, the effect of which is easily tested with an ohmmeter. If an in-circuit resistor indicates a value higher than marked value, replace it, if lower, lift one end and recheck. In general, resistors are reliable unless their power dissipation rating is exceeded. Wire wound resistors are prone to becoming open circuit, even under normal operation, and can be found by testing whether they are cold after the unit has been running for some time.

Transformers and power supply faults

Transformers and inductors usually go open circuit. Alternatively, transformers can 'burn out', made obvious by the smell. In this case, find out why the transformer burnt out before replacing it. Power supply transformers are usually protected by a fuse, and any inclination to increase the fuse rating should be avoided. A blown fuse is usually indicative of problems associated with circuitry that handles power, and not necessarily the power supply. A good servicing technique for this type of problem is to apply mains power to the unit being repaired through a 240 volt lamp in series with the power point and the device. Choose a wattage up to twice that required by the unit under test, and don't re-apply the mains directly until the fault is fixed. Figure 3 shows an arrangement that can be easily constructed for this.

Many domestic appliances are 'hot chassis'. This means that regardless of the way the active and neutral wires are connected, the metal chassis, or 'ground' of the device, is above the earth potential. Connecting an earth wire from a piece of test equipment can result in damage to the device being repaired, blown mains fuses, or similar disasters. Likewise, the serviceman runs a great chance of receiving a lethal electric shock. The use of an isolating transformer, a 240 volt to 240 volt transformer is essential. The power rating of the isolating transformer should equal or exceed that of the equipment. Note particularly that a 'Variac', or variable transformer is *not* suitable for this task.

Diodes can become open or short circuit. Power diodes in a bridge circuit usually go faulty in pairs, but it is good practice to replace the lot anyway. Be careful to use diodes that match the original, particularly as regards their PIV. As alreadv mentioned, power supply capacitors often become faulty, particularly the main filter capacitors. This is best confirmed by placing a similar value capacitor across the existing component. Be wary of the spark during charging, and discharge the test capacitor after its removal. This is necessary to prevent the possibility of it being picked up, (perhaps by the family dog), with the recipient being the discharge path for the often high potentials that can be stored for hours.

The intermittent fault

Intermittent faults are the bane of the serviceman. Difficult to find, you can never be sure if you have really fixed the fault. Bad soldered joints are typical intermittent faults, and are best found by the 'prod and probe' method. It often pays to simply spend time carefully resoldering every connection, taking care to note that each connection is in fact a good one. The possibility of merely dressing up a dry joint or a faulty connection is high, and the use of a magnifying glass is recommended.

An intermittent fault in a component can often be found using a can of freeze spray. If the general area of the fault can't be identified, spray methodically over the whole board. If the component is temperature sensitive, this technique will often find the problem. Often the fault will only appear after a certain operating temperature has been reached, in which case normal operation will follow when the faulty component is cooled down by the spray. By using a nozzle on the spray can, its effect can be localised, helping considerably in establishing the fault in a crowded layout. Heating a suspected component with a soldering iron,

then cooling it with the spray is another effective method of seeking out these types of problems.

In some cases, particularly in complex equipment, it is impractical to use the methods described above. When the intermittent fault is not temperature sensitive and all soldered joints have been tested, it becomes essential to narrow the problem down by identifying the area causing the problems. Various methods are used, including transferring plug-in cards from another unit of the same type, or attaching analysing equipment. The main requirement for this type of fault finding is patience. If parts are available, components from a whole section can be replaced, repeating the process until the fault is found.

Fault finding flow chart

Figure 4 shows a flow chart that summarises the fault finding technique described so far. No flow chart can cover all situations, but the suggested 'plan of attack' is a good way to start. Critics may suggest the chart is too simple or that the order is wrong. Experience will soon show you how to adapt the chart to particular situations, and its presentation is included merely as a pictorial means of helping the budding serviceman.

With the chart are four basic rules. The rules are not in any specific order, but the intended message is to be scientific about the task. Luck has always played a part in servicing, but you can never rely on it. Remember that if the device used to work, given enough time and effort it will again.

Typical construction errors

It is oft quoted that 'he who never made a mistake never made anything'. The construction error is not necessarily the province of the amateur, although experience generally helps in minimising these types of problems. Typical errors in circuit building are faulty soldering or pc track bridging, incorrect component orientation, incorrect components, mixed up wiring in external hardware, and so on. The likelihood of poor soldering decreases with experience, and for this and other obvious reasons, complex projects should only be undertaken after success with simpler exercises.

An incorrect component, or incorrect device orientation sound obvious enough problems but some bizarre possibilities are worth mentioning. Figure 5 shows some of the possibilities that constructors should be aware of. If a kit has been purchased it is possible that some components, particularly transistors, may have been substituted for that specified with the alternative having a different lead configuration from the original. Don't assume that the replacement device will always match the pcb layout provided for it. Similarly, components from several manufacturers may make up the kit, with different standards being employed to identify the polarisation. Typical of this is the way manufacturers show the polarity of an electrolytic capacitor. Some employ an arrow to point to the negative lead, others use the arrow to identify the positive lead.

Zener diodes can often be mistaken for conventional diodes, just as FETs, thyristors and other active devices may look the same. More insidious is the possibility of confusing the colour code of a resistor. A 12 ohm resistor, coloured brown, red, black can be easily mistaken for a 1k ohm resistor the code of which is brown, black, red. Low value resistors using silver or gold as part of the code for the value can be confused with others using these colours for the tolerance band. Another problem concerns capacitor value markings. It is very easy to mix up the decades, for example, a 0.01 μF capacitor with a 0.001 μF capacitor.

Integrated circuit polarising is usually identified with a recess on one end, or maybe with a dot next to pin 1. Some manufacturers mould two recesses in the case, one at either end, with one deeper than the other. The likelihood of inserting it the wrong way round is obvious. Switch connections are often confusing, and it usually pays to test which terminal is which with an ohmmeter.

Soldering errors

To help minimise soldering errors, particularly in missing a connection altogether, cut the component leads *after* they have been soldered. Generally a project kit will include instructions on the best way to go about building the circuit, with a preferred order of component installation. Ordinarily, wire links are first, followed by passive components, and active devices are in-

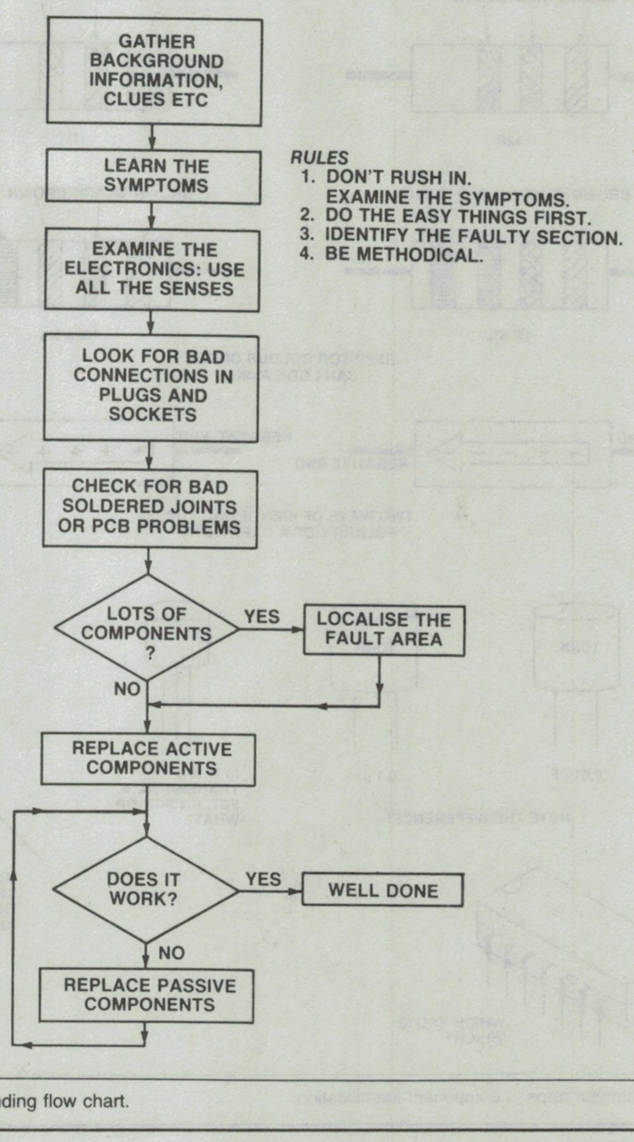


Figure 4. Fault finding flow chart.

stalled last. To expedite construction, the builder will often insert a number of components, then proceed to solder them in. By trimming the soldering leads after soldering, missed joints can be found as construction proceeds. By methodically doing a section at a time, a constant check can be maintained on the soldering processing, with simultaneous checks being made for solder bridges.

The rule is, check as you go, and recheck again and again. A magnifying glass is an excellent way of examining the board. Provide good lighting, and always fix an error as soon as you find it. Look also for strands of wire from multi-stranded cables that may be shorting across to another area. Wire of this type should be tinned before connecting it to the pcb, in order to solder the individual strands together.

Finding construction errors

As in all fault finding situations, an organised approach is essential. Being very open-minded about the fault is essential. All too often an issue is clouded with preconceptions about the nature of the fault. For example, a component that is too hot on the left side of the board may well mean that the fault is on the opposite side. How often have servicemen stared at a dead board only to find later that the power point wasn't turned on? Worse still is the possibility of replacing a good component with a faulty one, thus introducing another fault, or even having found the fault unknowingly.

Locating a construction error is similar to finding any fault, except many more possibilities are likely. Being aware of these possibilities is a good start, and the reader should note carefully the information already presented. Where possible, each section of a board should be proven as construction proceeds, particularly in complex circuits. For example, the power supply can often be constructed first and checked before anything else is built. Fault finding by confirming a section at a time, either during construction or servicing, is often the best means of narrowing down the area containing the problem.

Many constructors, when confronted with a problem in a newly built project proceed to strip it down and rebuild it. This is not a good idea, as apart from the work involved, the chances of reintroducing the fault are high. The probability of more faults occurring is also enhanced, as by now each component has undergone a lot of stress, just as the pcb will have received a caning. Unless the original job is of a very poor standard, persevere with the first attempt.

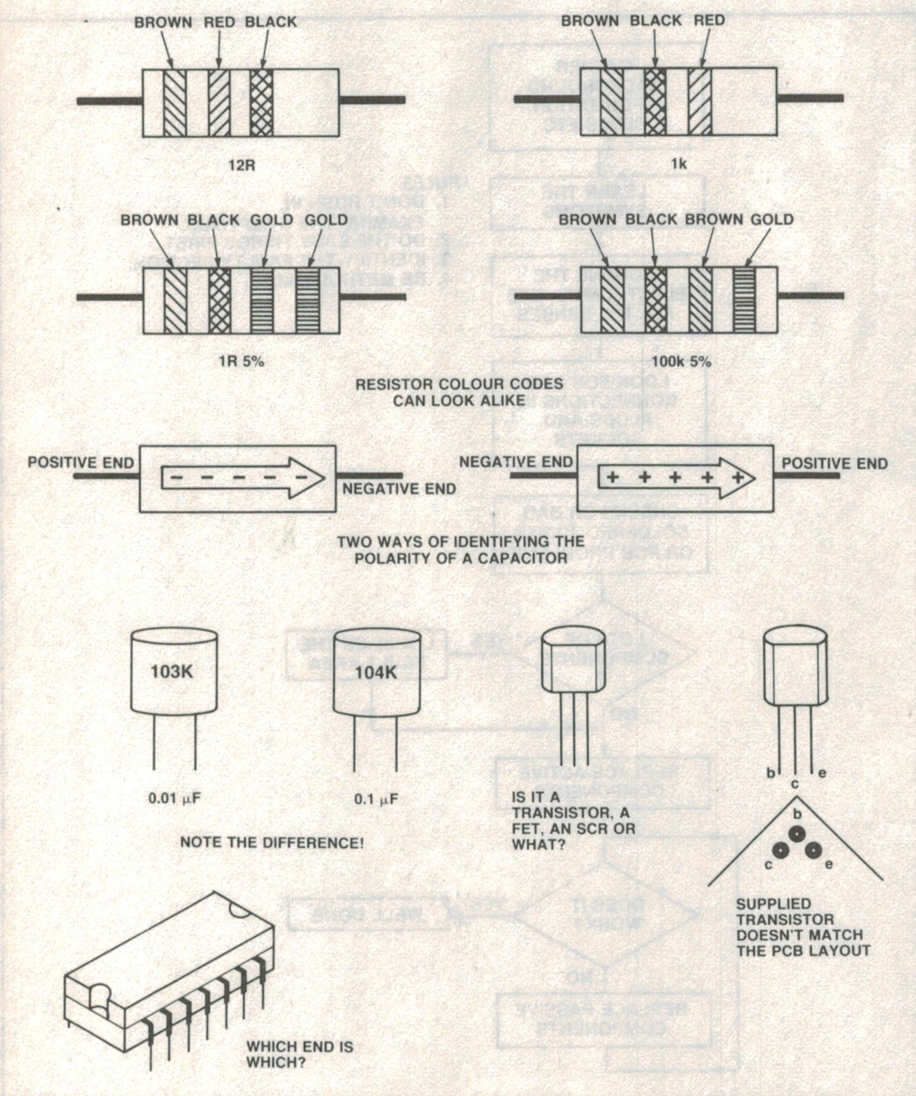


Figure 5. Common traps in component identification.

Design errors

As much as project designers try their best to prevent mistakes in the final presentation, errors do occur. These can be either printing errors, or a straight out problem in the design. With some designs values of components are critical and because of possible variation between individual items, duplicating the device may be a matter of chance. Others may under-rate component specifications, causing a premature demise of the unit. Designs with these faults are unusual, and represent a poorly researched product.

In general, if a project has been around for a while, printing errors will have been discovered and listed in an errata section in the relevant magazine. The smart constructor always waits until the next issue before building the project! The assumption that a design error is present is often made prematurely; it is always easy to blame someone else when the thing doesn't work. It is worthwhile remembering that an electronics magazine relies on the quality of its construction projects, as a reputation is at stake.

Summary

This article has purposely stayed away from describing any technical fault finding methods. A knowledge of Ohm's law and its implications is very useful, and in many cases is indispensible. Given this background and a multimeter, servicing becomes easier, as faults can often be found very quickly. By noting the hints presented here, those starting out in electronics can give it a try.

Although they may not care to admit it, many servicemen repair equipment that they know nothing about by using the methods that have been outlined. ●

The DSE Multitech PC

DSE and Multitech, one of the largest PC manufacturers outside the US, have released an IBM-compatible computer, the DSE Multitech.

It incorporates such features as RS-232C serial port, real time clock/calendar with battery backup, sound circuitry, parallel printer port and an IBM-compatible expansion slot (on Systems One and Two only).

Other features include an 8088 16-bit internal processor running at 4.77 MHz; 256 expanded ASCII character set; an IBM-compatible colour graphics interface with 640 x 200, 320 x 400 graphics resolutions and 16-colour text mode; a video interface with special flicker free circuitry to reduce eye strain; RGB and composite video monitor outputs; joystick/game adapter port; and an inbuilt speaker.

The PC is compatible with the MS-DOS operating system, so there is a large software base from which to draw, including the Flight Simulator, Jet, Sidekick, Lotus 1-2-3, Open Access, Aura or Enable. Most of the popular software is ready to run.

The computer is available in three pre-configured versions:

The System One (Cat X-8000) for $1345 is the low cost entry level version. It comes complete with 360K floppy disk drive, 128K of RAM, MS-DOS version 2.11 and three months warranty.

The System Two (Cat X-8001) for $1995 comes with two 360K floppy disk drives, 256K of RAM, MS-DOS 2.11, the Easy wordprocessing package from MicroPro, complete with spelling checker and six months on-site service in major capital centres.

The System Three (Cat X-8002) for $3995 is the DSE Multitech business system with 512K of RAM, one 360K floppy disk drive, one 10 MB hard disk drive, and the Aura package which will perform all normal business operations such as wordprocessing, spreadsheet, database and information management. It also comes with six months on-site service agreement (major capital centres only). System Three can be installed free in your home or business (again, major capital centres only).

Using the DSE Multitech.

See our review on page 89.

Modem development by Barson in Australia

Bruce Reid of Netcom and Barson Research's Steve Lucket with the internal modem card mounted on the lid of the BBC microcomputer.

Barson Computers Australasia is receiving both Australian orders and international inquiries for an innovative modem product the company has developed for the BBC microcomputer.

The auto-dial modem, developed in NSW by Barson Research and DataNetComm Australia, is being manufactured by Netcom in Sydney, and built into the BBC systems at Barson's manufacturing plant in North Ryde.

Netcom has already begun delivery of the first 500 units of the product, sold to fill an order from Thorn-EMI.

According to Julian Barson, Barson's Managing Director, "The unit uses new chip technology, which has enabled us to design a unit compact enough to fit inside the slim BBC computer cabinet. We were fortunate that Netcom had both the technology and the equipment to manufacture the unit for us."

The new modem also includes on-board software that can turn the BBC computer into a videotex terminal. Other features allow the user to dial up other systems automatically, to store the text they receive, and a printer driver enabling information to be sent to a printer.

The software also enables the user to select either 300/300 or 1200/75 baud communication speeds.

Mr Barson said development of the product began in June this year. "Since then we have received a number of serious inquiries from places such as Hong Kong and the USA. Product shipped to these countries will all be manufactured in NSW."

For further information contact **Barson Computers, 335 Johnston Street, Abbotsford, Vic 3067. (03)419-3033.**

X.25 gateway for BBC networks

BBC/Acorn has released the Econet-X.25 gateway to allow those with Econet terminals access to host computers connected to X.25 networks such as Austpac. Econet-X.25 supports up to seven window sizes and data packet sizes up to 128 bytes. The system hardware is based on a BBC 6502 microcomputer and two separate Z80 processors running at 6 MHz, 96K of RAM and a 32K EPROM. For more information contact Barson Computers, 335 Johnston St, Abbotsford, Vic 3067. (03)419-3033.

Graphics emulation software for IBM-PC

Grafpoint Corp has released the TGRAF-07 software package for the IBM-PC, XT and AT. The package emulates such functions as zoom and pan, which can be assigned to each of the 64 windows that are possible on the screen. The package, with appropriate hardware, promises to be cheaper than the Tektronix (R) terminal. It is available from Dimension Graphics, 265 Miller St, Nth Sydney, NSW 2060. (02)929-5855.

Microsoft COBOL tools

Microsoft has introduced a set of utilities — or COBOL tools — for programmers developing, debugging, maintaining and enhancing on MS-DOS operating systems. The tools include a symbolic debugger, a cross-reference utility, a menu handler and a mouse input module.

$4m worth from IBM Aust

Idaps Australia has recently installed $4m worth of hardware and software from IBM Aust in its Melbourne data centre. The equipment includes a 3083EX mainframe with 16 Mbytes of main memory and 16 channels, seven 2.5 Mbyte 3380 disk drives, three 3880 disk controllers, a 3725 communications controller as well as workstations and workstation controllers.

Intel source code editor for PC-DOS

Intel has introduced an editor for creating and editing source and object code as well as text. It's called Aedit-DOS, designed specifically for engineering software needs. It runs on computers using the PC-DOS 3.0 operating system, Intel's Intellec Series III and IV development systems and on Intel's iRMX operating system. For more information contact Intel Aust, Level 6, 200 Pacific Hwy, Crows Nest, NSW 2065. (02)957-2744.

Tasman word processor

The Tasword 6128 word processor for the Amstrad CPC-6128, published by Tasman Software of the UK is being distributed in Australia by Dolphin Computers. Dolphin is also distributing a spelling check program called Tas-spell for the Amstrad CPC-664 and 6128 computers, and the Sureshot Supreme joystick. Dolphin computers is at 2/7 Waltham St, Artarmon, NSW 2064. (02)438-4933.

Forth for IBM-PC and Apple IIe

Forth language programs and data are now available from Waveonic Associates. A full screen editor and assembler are provided in relocatable, binary overlays. A CForth compiler is also available to speed up critical applications. This series of Forth implementations is also available for 8080, Z80, 8086/88

BRIEFS

and 68000 based processors. For more information contact Waveonic at 199 Watts Rd, Wilson, WA 6107. (09)451-2946.

Aust developed LAN product

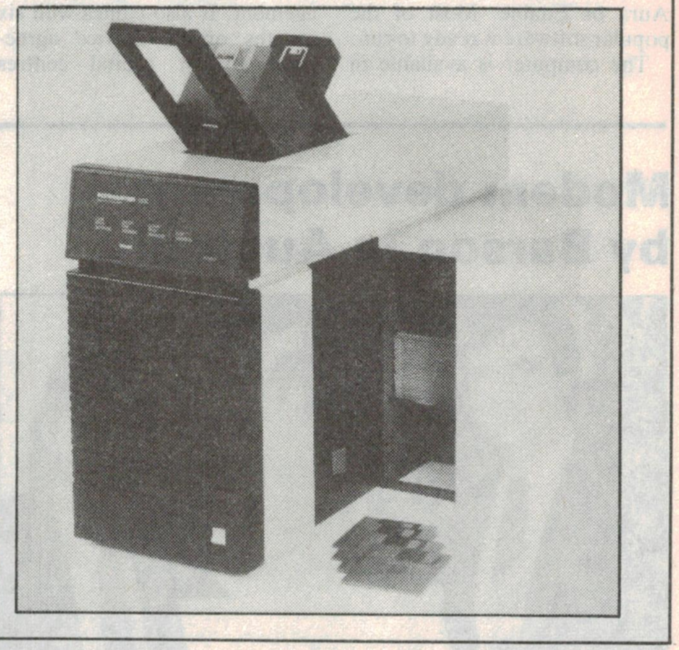
The first LAN component developed by Digital Equipment's Artarmon design and manufacturing centre is a statistical multiplexer server. Called the MUXserver 100, it connects remote, non-intelligent terminals to hosts in the Ethernet local area network. It's available for $10,000 or so. Digital Equipment is at the Northern Tower, Chatswood Plaza, Railway St, Chatswood, NSW 2067.

File saving system

Datacraft Office Systems has available the Irwin Backup Tape subsystem which creates duplicate file copies on hard disk, with assured compatibility between tape drives. The subsystem plugs into an existing floppy connector on the back of a PC and is said to store 10 million bytes on a single cartridge, in about 16 minutes which includes the verification process. For more information contact Datacraft at 1st Floor, 30 Atchison St, St Leonards, NSW 2065. (02)438-3688.

Diskette copying

Nashua is distributing three devices to facilitate disk copying processes. The Nashua Automatic Diskette Copier formats a blank diskette for the computer concerned, copies information on it from an original and checks it. The more complex Series One Duplicator can be configured in various formats and reportedly copies one double sided diskette in up to 60 seconds. The Formaster Sprint, another copying device, consists of a board/software arrangement which uses an IBM-XT as host to produce Apple, Commodore or IBM formatted disks. For further information contact Nashua, 34 Chandos St, St Leonards, NSW 2065. (02)925-3111.



CLUB CALL

Those interested in the **LE'VZ200/300 User Group** can contact John D'Alton, 39 Agnes St, Toowong, Qld 4066. (07)371-3707.

The electronics and computer club of the **Randwick-Botany Police Citizens Youth Club** meets at 6 pm on Thursdays at Bunnerong Rd, Daceyville, NSW. Membership is free.

The main event — PC86

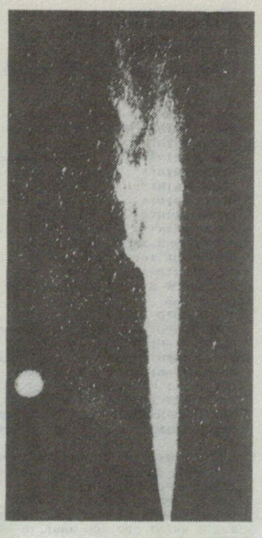
The sixth Australian Computer Show (PC86) is to be held this month, from 12 to 16 March at Centrepoint in Sydney. Companies exhibiting include IBM, Apple, Commodore, Tandy, Hewlett-Packard, Sperry, Barson, Teleco, Epson, Microsoft and Ericsson.

Halley's Comet

Noel Bailey,
Maryland, NSW 2287

This program calculates the declination and right ascension for Halley's Comet. All one need enter is the date. The algorithm has been taken from the 2nd edition of *Practical astronomy with your calculator* by P. Durfett-Smith, published by Cambridge University Press. The author states that the precision of the algorithm will be limited due to the influences of the planets, however the comet should still be within one degree of the calculated position.

The accuracy of the program has been checked against published values for 1985 and this program is within one degree. For 1986 I have no published values, however, the calculated values do appear very close to a track drawn on a published star chart right up to 1 June, 1986.



```
ØØ1ØØ REM "HALLEY" PROGRAM TO FIND THE DECLINATION AND RIGHT
ØØ11Ø REM ASCENSION OF HALLEY'S COMET - FROM "PRACTICAL
ØØ12Ø REM ASTRONOMY WITH YOUR CALCULATOR" - P DUFFETT-SMITH
ØØ13Ø REM PUBLISHED BY CAMBRIDGE UNIVERSITY PRESS, 2ND ED 1981.
ØØ14Ø REM WRITTEN IN BASIC BY NOEL BAILEY 27 OCTOBER 1985
ØØ15Ø PRINT"HALLEY'S COMET PROGRAM. GIVE ME THE DAY, MONTH"
ØØ16Ø PRINT"AND YEAR AND I WILL CALCULATE THE RIGHT ASCENSION"
ØØ17Ø PRINT"AND DECLINATION FOR THE COMET."
ØØ18Ø INPUT"DAY,MONTH,YEAR",D7,M7,Y6
ØØ19Ø Y=INT(Y6):Y7=Y6
ØØ2ØØ IF M7 > 2 THEN 26Ø
ØØ21Ø M7 = M7-1
ØØ22Ø IF Y-Y/4*4=Ø THEN LET M7=M7*62ELSE LET M7=M7*63
ØØ23Ø M7=M7/2
ØØ24Ø M7=FLT(INT(M7))
ØØ25Ø GOTO 3ØØ
ØØ26Ø M7=M7+1
ØØ27Ø M7=M7*3Ø.6
ØØ28Ø M7=FLT(INT(M7))
ØØ29Ø IF Y-Y/4*4=Ø THEN LET M7=M7-62 ELSE LET M7=M7-63
ØØ3ØØ M7 = M7+D7
ØØ31Ø D6=Ø
ØØ32Ø IF Y6 = 198Ø THEN 36Ø
ØØ33Ø FOR Y=198Ø TO INT(Y6)-1
ØØ34Ø IF Y-Y/4*4=Ø THEN LET D6=D6+366 ELSE LET D6=D6+365
ØØ35Ø NEXT Y
ØØ36Ø D6 = D6+M7:REM TOTAL DAYS SINCE THE EPOCH 198Ø
ØØ37Ø D1=D6
ØØ38Ø Y1=D6/365.2422+198Ø
ØØ39Ø Y2 = Y1-1986.112
ØØ4ØØ T1 = 76.ØØ81: M1 = 36Ø*Y2/T1
ØØ41Ø IF ABS(M1)>36Ø THEN LET M1= M1 - FLT(INT(M1/36Ø)*36Ø)
ØØ42Ø IF M1 < Ø THEN LET M1 = M1+36Ø
ØØ43Ø P1 = 355/113
ØØ44Ø M1 = M1*P1/18Ø
ØØ45Ø REM NEWTON'S METHOD OF SOLVING FOR E
ØØ46Ø T1 = 1
ØØ47Ø DØ = T1/1E5
ØØ48Ø TØ = T1
ØØ49Ø GOSUB 59Ø
ØØ5ØØ F1 = FØ
ØØ51Ø TØ = T1 + DØ
ØØ52Ø GOSUB 59Ø
ØØ53Ø G1 = (FØ - F1)/DØ
ØØ54Ø T2 = T1 - F1/G1
ØØ55Ø IF ABS(T1-T2) < 1E-5 THEN 57Ø
ØØ56Ø T1 = T2: GOTO 47Ø
ØØ57Ø REM
ØØ58Ø GOTO 61Ø
ØØ59Ø FØ = (TØ-Ø.9673*SIN(TØ))-M1
ØØ6ØØ RETURN
ØØ61Ø EØ = T1
ØØ62Ø VØ = 2*ATAN(7.7564215*SIN(EØ/2)/COS(EØ/2))
ØØ63Ø VØ=VØ*18Ø/P1
ØØ64Ø LØ = VØ+17Ø.Ø11Ø
ØØ65Ø RØ = 1.1543197/(1+Ø.9673*COS(VØ*P1/18Ø))
ØØ66Ø PØ = Ø.3Ø5Ø573*SIN((LØ-58.154Ø)*P1/18Ø)
ØØ67Ø PØ = ATAN(PØ/SQR(1-PØ*PØ))*18Ø/P1
ØØ68Ø YØ = SIN((LØ-58.154Ø)*P1/18Ø)*COS(162.2384*P1/18Ø)
ØØ69Ø XØ = COS((LØ-58.154Ø)*P1/18Ø)
ØØ7ØØ L1 = ATAN(YØ/XØ)*18Ø/P1
ØØ71Ø IF YØ>Ø AND XØ <Ø THEN LET L1 = L1+18Ø
ØØ72Ø IF YØ<Ø AND XØ <Ø THEN LET L1 = L1+18Ø
ØØ73Ø IF YØ<Ø AND XØ >Ø THEN LET L1 = L1+36Ø
ØØ74Ø L1 = L1+58.154Ø
ØØ75Ø IF L1 > 36Ø THEN LET L1 = L1-36Ø
ØØ76Ø R1=RØ*COS(PØ*P1/18Ø)
ØØ77Ø REM NOW THE CALCS FOR THE EARTH
ØØ78Ø N1 = 36Ø/365.2422*D1/1.ØØØØ4
ØØ79Ø N1 = N1-FLT(INT(N1/36Ø)*36Ø)
ØØ8ØØ MØ = N1+98.83354-1Ø2.5964Ø
ØØ81Ø ZØ =36Ø/P1*Ø.Ø16718
ØØ82Ø Z1 = SIN(MØ*P1/18Ø)
ØØ83Ø L2 = N1+ZØ*Z1+98.83354
ØØ84Ø IF L2 > 36Ø THEN LET L2 = L2-36Ø
ØØ85Ø IF L2 < Ø THEN LET L2 = L2+36Ø
ØØ86Ø V1 = L2-1Ø2.5964Ø
ØØ87Ø R2 = (1-.Ø16718*.Ø16718)/(1+.Ø16718*COS(V1*P1/18Ø))
ØØ88Ø IF R1 > R2 THEN 93Ø
ØØ89Ø ZØ = R1*SIN((L2-L1)*P1/18Ø)
ØØ9ØØ Z1 = R2-R1*COS((L2-L1)*P1/18Ø)
ØØ91Ø D2 = 18Ø+L2+ATAN(ZØ/Z1)*18Ø/P1
ØØ92Ø GOTO 96Ø
ØØ93Ø ZØ = R2*SIN((L1-L2)*P1/18Ø)
ØØ94Ø Z1 = R1-R2*COS((L1-L2)*P1/18Ø)
ØØ95Ø D2 = ATAN(ZØ/Z1)*18Ø/P1+L1
ØØ96Ø IF D2 < Ø THEN LET D2 = D2+36Ø
ØØ97Ø ZØ = R1*SIN(PØ*P1/18Ø)/COS(PØ*P1/18Ø)*SIN((D2-L1)*P1/18Ø)
ØØ98Ø Z1 = R2*SIN((L1-L2)*P1/18Ø)
ØØ99Ø BØ = ATAN(ZØ/Z1)*18Ø/P1
Ø1ØØØ ZØ = SIN(D2*P1/18Ø)*COS(23.44188*P1/18Ø)
Ø1Ø1Ø Z1 = SIN(BØ*P1/18Ø)/COS(BØ*P1/18Ø)*SIN(23.44188*P1/18Ø)
Ø1Ø2Ø ZØ = ZØ-Z1
Ø1Ø3Ø Z1 = COS(D2*P1/18Ø)
Ø1Ø4Ø A1 = ATAN(ZØ/Z1)*18Ø/P1
Ø1Ø5Ø IF ZØ>Ø AND Z1<Ø THEN LET A1 = 18Ø+A1
Ø1Ø6Ø IF ZØ<Ø AND Z1<Ø THEN LET A1 = 18Ø+A1
Ø1Ø7Ø IF ZØ<Ø AND Z1>Ø THEN LET A1 = 36Ø+A1
Ø1Ø8Ø A1=A1/15
Ø1Ø9Ø ZØ=SIN(BØ*P1/18Ø)*COS(23.44188*P1/18Ø)
Ø11ØØ Z1=COS(BØ*P1/18Ø)*SIN(23.44188*P1/18Ø)*SIN(D2*P1/18Ø)
Ø111Ø Z2= ZØ+Z1
Ø112Ø S1 = ATAN(Z2/SQR(1-S2*S2))*18Ø/P1
Ø113Ø H = INT(A1):M = INT((A1-FLT(H))*6Ø)
Ø114Ø PRINT"RIGHT ASCENSION = ";H;" HOURS  ";M;" MINUTES"
Ø115Ø D = INT(S1):M = INT((S1-FLT(D))*6Ø)
Ø116Ø PRINT"DECLINATION     = ";D;" DEGREES ";M;" MINUTES"


>D
>RUN

HALLEY'S COMET PROGRAM. GIVE ME THE DAY, MONTH
AND YEAR AND I WILL CALCULATE THE RIGHT ASCENSION
AND DECLINATION FOR THE COMET.
DAY,MONTH,YEAR 17,5,1985
RIGHT ASCENSION =  5 HOURS   5 MINUTES
DECLINATION     =  16 DEGREES  6 MINUTES

>RUN

HALLEY'S COMET PROGRAM. GIVE ME THE DAY, MONTH
AND YEAR AND I WILL CALCULATE THE RIGHT ASCENSION
AND DECLINATION FOR THE COMET.
DAY,MONTH,YEAR 1,12,1985
RIGHT ASCENSION =  1 HOURS   3 MINUTES
DECLINATION     =  13 DEGREES  3 MINUTES

>RUN

HALLEY'S COMET PROGRAM. GIVE ME THE DAY, MONTH
AND YEAR AND I WILL CALCULATE THE RIGHT ASCENSION
AND DECLINATION FOR THE COMET.
DAY,MONTH,YEAR 2Ø,3,1986
RIGHT ASCENSION =  19 HOURS   42 MINUTES
DECLINATION     = -23 DEGREES -4Ø MINUTES

>RUN

HALLEY'S COMET PROGRAM. GIVE ME THE DAY, MONTH
AND YEAR AND I WILL CALCULATE THE RIGHT ASCENSION
AND DECLINATION FOR THE COMET.
DAY,MONTH,YEAR 1Ø,4,1986
RIGHT ASCENSION =  15 HOURS   15 MINUTES
DECLINATION     = -36 DEGREES -23 MINUTES

>RUN

HALLEY'S COMET PROGRAM. GIVE ME THE DAY, MONTH
AND YEAR AND I WILL CALCULATE THE RIGHT ASCENSION
AND DECLINATION FOR THE COMET.
DAY,MONTH,YEAR 1,6,1986
RIGHT ASCENSION =  1Ø HOURS   23 MINUTES
DECLINATION     = -6 DEGREES -27 MINUTES

>OUT#1 OFF
```

Three dimensional PI chart

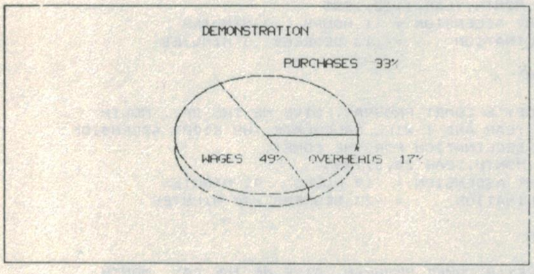
Richard Bushell,
Baulkham Hills, NSW 2153

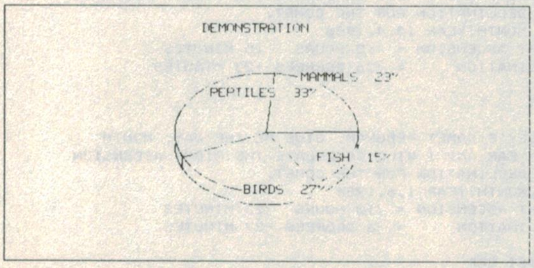
This program will plot a 3D PI chart to your specification in hi-res graphics. The screen can be dumped to an XX-80 type printer. The printer is set up to run on the serial port at 300 baud.

The printer port can be changed by editing line 530.

For best results, the number of segments should be restricted to a maximum of five.

```
00100 ON ERROR GOTO 670
00110 DIM A1(20),X(20),Y(20),S1(20),S2(20),P1(20)
00120 CLS
00130 PRINT TAB(22)"PI CHART"\TAB(19)"R.BUSHELL 1985"\
00140 REM ***** INPUT DATA
00150 INPUT "HEADING ? ";H1$
00160 INPUT "No. OF SECTIONS ? ";S
00170 FOR G=1 TO S: CLS : PRINT "Section No. "G" name ";:INPUT S1$(G)
00180 PRINT "Data for segment "G" ";:INPUT S2(G)
00190 T1=T1+S2(G) : NEXT G
00200 FOR G=1 TO S
00210 P1(G)=P1(G-1)+S2(G)/T1*100
00220 A1(G)=P1(G)*3.1416/50
00230 X(G)=INT(255+COS(A1(G))*90)
00240 Y(G)=INT(128-SIN(A1(G))*60)
00250 P1(G-1)=S2(G-1)/T1*100
00260 NEXT G
00270 P1(S)=S2(G)/T1*100
00280 CLS: HIRES
00290 PLOT 0,0 TO 511,0 TO 511,255 TO 0,255 TO 0,0 :REM PLOT BORDER
00300 CURS (64-LEN(H1$))/2,2:PRINT H1$
00310 U=255:I=128
00320 REM ***** DRAW CIRCLE
00330 FOR M=1 TO 2
00340 FOR TO=0 TO 44/7 STEP .012
00350 SETH U+INT(90*COS(TO)),I+INT(60*SIN(TO))
00360 IF M=2 AND TO=3.144 THEN NEXT*TO 380
00370 NEXT TO
00380 I=140 : NEXTM : I=128
00390 REM ***** DIVIDE THE CIRCLE UP INTO SEGMENTS
00400 FOR G=1 TO S
00410 PLOTH 255,128 TO X(G),Y(G)
00420 IF Y(G)>128 THEN LET M=INT(140-SIN(A1(G))*60): PLOTH X(G),Y(G) TO X(G),M
00430 X(G)=32+INT(COS((A1(G)+A1(G-1))/2)*8)
00440 Y(G)=8-INT(SIN((A1(G)+A1(G-1))/2)*5)
00450 CURS X(G),Y(G):PRINT S1$(G)" "INT(P1(G))"%";
00460 NEXT G
00470 CURS 10,15: PRINT "DUMP TO PRINTER ? ";
00480 A2$=KEY:IF A2$="" THEN 480
00490 PRINT A2$;
00500 IF A2$<>"Y" AND A2$<>"y" THEN END
00510 CURS 10,15: PRINT [A35 32];
00520 REM ****** START PRINTER DUMP
00530 OUTL#4: RESTORE 630
00540 FOR X=336 TO 371 : READ Y : POKE X,Y : NEXT X
00550 LPRINT CHR(27);"A";CHR(8);
00560 FOR Y=0 TO 15
00570 FOR U=0 TO 8 STEP 8 : LPRINT CHR(27)"K"CHR(0)CHR(2);
00580 FORX=0 TO63: A=USR(336,61440+U+16*PEEK(61440+Y*64+X)) : NEXT X
00590 LPRINT CHR(10);
00600 NEXT U : NEXT Y
00610 LPRINT CHR(27)"2"CHR(7);
00620 END
00630 DATA 62,01,211,11,96,105,14,128,229,6,8,203,34,126,161
00640 DATA 40,2,203,194,35,16,245,122,205,69,128,225,203,57
00650 DATA 48,233,61,0,211,11,201
00660 REM ****** PCG OVERFLOW
00670 CLS : PRINT "CATASTROPHIC SYSTEM ERROR - PROGRAM WILL RE-RUN ":PLAY 1,2;5,
3;9,1 : RUN
```





Reactance

R. Wilkinson,
Nelson Bay, NSW 2315

```
00010 CLS
00020 PRINT "NAME 'REACT'ance.......  18/8/84.... R.WILKINSON."
00030 PRINT
00040 PRINT"      This program calculates the Reactance of"
00050 PRINT"      a capacitor  to a  certain  Frequency."
00060 PRINT"      ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~"
00070 PRINT"      It also gives Inductance values of Coils"
00080 PRINT"      based on Frequency and  100 Pf Capacitor"
00090 PRINT"      =========================================="
00095 CURS 30,15:PRINT "WAIT"
00100 FOR T=1 TO 5000: NEXT T
00110 GOTO 310
00120 FOR B=1 TO 5000: NEXT B
00130 CLS
00140 GOTO 220
00150 INPUT "  (REACT) State frequency  (in MHz)";F1
00160 X1=F1:F1=X1*1.0E+06
00170 INPUT"           What capacitance (in Pf) ";C1
00180 Y1=C1: C1=Y1/1.0E+06^2
00190 LET P1=3.14159*2
00200 LET Z1=1/(P1*F1*C1)
00210 PRINT:PRINT Z1" REACTANCE IN OHMS": PRINT
00220 PRINT "Do you want REACTANCE or INDUCTANCE or END ?  input R, I or E":PRIN
T
00230 U0$=KEY$: IF U0$="" THEN GOTO230 ELSE IF U0$="I" THEN GOTO240 ELSE IF U0$=
"R" THEN GOTO150 ELSE IF U0$="E" THEN GOTO 420
00240 INPUT "(INDUCT) FREQUENCY   in MHz. ";F1
00250 F1=F1*F1: PRINT :PRINT
00260 M1=250/F1:PRINT M1 "= INDUCTANCE IN MICROHENRIES":PRINT
00270 PRINT "DO YOU WANT TO GO BACK  Y/N "
00280 PRINT
00290 INPUT V0$
00300 IF V0$="Y"OR V0$="y" THEN 220 ELSE IF V0$="N" OR V0$="n"THEN 420
00310  HIRES
00315 CURS 30,5: PRINT"WAIT"
00320 PLOT 65,0 TO 300,0
00330 PLOT 65,0 TO 65,120
00340 PLOT 65,120 TO 300,120
00350 PLOT 300,120 TO 300,0
00360 CURS 24,12:PRINT"1"
00370 CURS 13,13:PRINT" Zc= ------------ ohms"
00380 CURS 18,14:PRINT" 2 pi  f  c"
00390 CURS 12,15:PRINT "======================="
00400 CURS 15,10:PRINT "FORMULA FOR ABOVE"
00410 GOTO 120
00420 CURS 45,16:PRINT "THATS THE END"
```

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Secondly, if you present us with a neat final copy of your program we can use photographic techniques to reproduce it in the magazine, without risk of errors.

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*Breach of copyright is now a criminal offence.

Name ....

Signature .... **Date** ....

Address ....

.... **Postcode** ....

Hard Lo-res

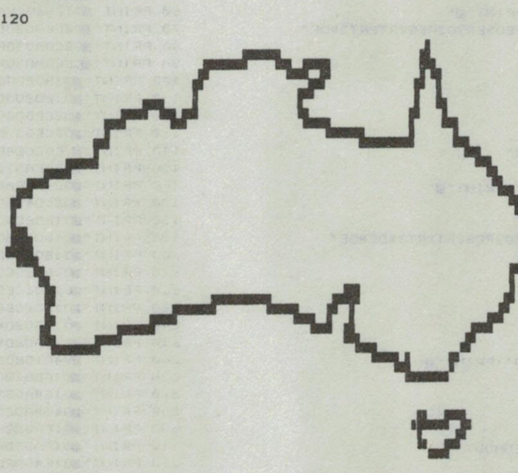
Sean Machin,
Lismore, NSW 2480

This program allows you to draw lo-res pictures on the screen and then dump them to your printer. It consists of two parts, a simple lo-res drawing routine (lines 130 to 290) and the printer routine (310-350). In the drawing section there are three modes of operation: 'set' where the pixel moves according to your key instructions, 'reset', where it moves destructively and 'move', where it is non-destructive. The relevant keys are Q for up, A for down, [for left and] for right.

Tab activates the print routine. Different effects can be obtained by changing the vertical line spacing (CHR(27);"3";CHR(n)) and by changing the print character in line 330.

```
00100 REM LORES TO PRINTER DUMP
00110 REM BY SEAN MACHIN
00120 CLS:OUTL#1:LPRINT CHR(27);"@";CHR(27);"3";CHR(20);CHR(15):REM INITIALIZE P
RINTER
00130 LORES:X=63:Y=24:R=3:GOTO 260:REM START IN MOVE MODE
00140 K1$=KEY
00150 IF K1$="Q":Y=Y+1:REM UP
00160 IF K1$="A":Y=Y-1:REM DOWN
00170 IF K1$="]":X=X+1:REM RIGHT
00180 IF K1$="[":X=X-1:REM LEFT
00190 IF K1$=CHR(9):PLAY 22,4:GOTO 300:REM DUMP SCREEN
00200 IF K1$="C":R=R+1:IF R>3:R=1:REM CHANGE MODE
00210 IF K1$="" AND R<>1:INVERT X,Y:INVERT X,Y:GOTO 140
00220 IF X<0:X=0
00230 IF X>127:X=127
00240 IF Y<0:Y=0
00250 IF Y>47:Y=47
00260 IF R=1:SET X,Y:CURSO:PRINT"SET";SPC(2)
00270 IF R=2:INVERT X,Y:RESET X,Y:CURSO:PRINT"RESET"
00280 IF R=3:INVERT X,Y:INVERT X,Y:CURSO:PRINT"MOVE";SPC(1)
00290 GOTO 140
00300 CURSO:PRINT SPC(5):REM ERASE PRINTED MODE
00310 FORY=47 TO 0 STEP-1
00320 WO$="":FORX=0 TO 127
00330 IF POINT(X,Y):WO$=WO$+CHR(17) ELSE LET WO$=WO$+" "
00340 NEXTX:IF WO$<>"" THEN LPRINT WO$ ELSE LPRINT
00350 NEXTY
00360 GOTO 120
```

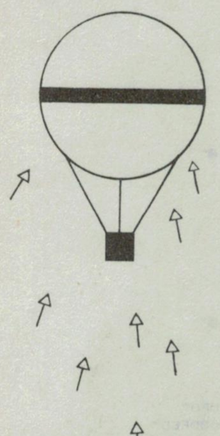
Sample:



Balloon Dodge

G. Gajic,
Kensington, Vic 3031

You must dodge arrows being shot up at you from the ground. Your position is represented by a balloon. If the arrows hit you then the balloon bursts.



```
10 REM OBSTICAL COURSE FOR COMMODORE 64
20 REM (C) COPYRIGHT BY GARY GAJIC
30 POKE53280,0:POKE53281,0
40 PRINT"█████████";:PRINTTAB(11)"█OBSTICAL COURSE█"
50 PRINTTAB(13)"███PLEASE WAIT":FORTT=1TO1000:NEXT:PRINTTAB(13)"███HIT ANY KEY"
60 PRINTTAB(9)"███Z - LEFT   C - RIGHT":PRINTTAB(10)"███(C) BY GARY GAJIC"
70 GETR$:IFR$=""THEN70
80 DIMA$(9):FORT=1TO9:READA$(T):NEXT
90 A=1044:SC=0:PRINT"████████████"
100 GETA$:IFA$=""ANDPEEK(56320)=127THEN130
110 IFA$="Z"ORPEEK(56320)=123ANDA>1040THENA=A-1
120 IFA$="C"ORPEEK(56320)=119ANDA<1047THENA=A+1
130 POKEA,81:SC=SC+1:IFPEEK(A+40)=102THEN300
140 PRINTTAB(15)A$(INT(RND(1)*8)+1)
150 POKEA,81
160 FORT=1TO30:NEXT
170 GOTO 100
200 DATA"▒▒▒        ▒"
210 DATA"▒ ▒        ▒"
220 DATA"▒  ▒       ▒"
230 DATA"▒   ▒      ▒"
240 DATA"▒    ▒     ▒"
250 DATA"▒     ▒    ▒"
260 DATA"▒      ▒   ▒"
270 DATA"▒        ▒▒▒"
280 DATA"▒          ▒"
300 PRINT"██ YOU ██CRASHED██ INTO AN OBSLTICAL !!!"
310 PRINT" YOU SCORED"SC
320 PRINT" PLAY AGAIN (█Y█/█N█)"
330 GETD$:IFD$=""THEN330
340 IFD$="Y"THENRUN
350 IFD$="N"THENPRINT"██":POKE53280,254:POKE53281,246:END
360 GOTO 330
```

'FUR ELISE'

```
10 REM**(C) 1984 BY:**
20 REM*CHRIS GROENHOUT
30 PRINTCHR$(8)+CHR$(14)
40 PRINT"█████|AGATELLE IN ♠ \INOR":PRINT"████K '-UR ¬LISE')"
50 PRINT"█ BY: L.X.|EETHOVEN"
60 PRINT"█████K 1770-1827)"
70 PRINT"█S2T3V5"
80 PRINT"█O3E#DE#DE02B03DC"
90 PRINT"█S101AS202A01EA02CEA"
100 PRINT"█S101ES202B01E#G02E#GB"
110 PRINT"█S101AS203C01EA02E03E#D"
120 PRINT"█O3E#DE02B03DC"
130 PRINT"█S101AS202A01EA02CEA"
140 PRINT"█S101ES202B01E#G02D033C02B"
150 PRINT"█S101AS202A01EA03T2RT3E#D"
160 PRINT"█O3E#DE02B03DC":PRINT"█"
170 PRINT"█S101AS202A01EA02CEA"
180 PRINT"█S101ES202B01E#G02E#GB"
190 PRINT"█S101AS203C01EA02E03E#D"
200 PRINT"█E#DE02B03DC"
210 PRINT"█S101AS202A01EA02CEA"
220 PRINT"█S101ES202B01E#G02D03C02B"
230 PRINT"█S101AS202A01EA02B03CD"
240 PRINT"█V7S102CS203E01G02CG03FE"
250 PRINT"█S101GS203D01G02F03ED"
260 PRINT"█S101AS203C01EA02E03DC":PRINT"█"
270 PRINT"█V5S101ES202B01E02EE03E02E03ES303RES2RT2RT3#DE"
280 PRINT"█#DE#DE#DE#DE#DE02B03DC"
290 PRINT"█S101AS202A01EA02CEA"
300 PRINT"█S101ES202B01E#G02E#GB"
310 PRINT"█S101AS203C01EA02E03E#D"
320 PRINT"█E#DE02B03DC"
330 PRINT"█S101AS202A01EA02CEA"
340 PRINT"█S101ES202B01E#G02D03C02B"
350 PRINT"█S101AS202A01EA02B03CD"
360 PRINT"█V7S102CS203E01G02CG03FE":PRINT"█"
370 PRINT"█S101GS203D01G02F03ED"
380 PRINT"█S101AS203C01EA02E03DC"
390 PRINT"█V5S101ES202B01E02EE03ES303RES2RT2RT3#DE#DE"
400 PRINT"█V4#DE#DE#DE#DE02B03DC"
410 PRINT"█S101AS202A01EA02CEA"
420 PRINT"█S101ES202B01E#G02E#GB"
430 PRINT"█S101AS203C01EA02E03E#D"
440 PRINT"█E#DE02B03DC"
450 PRINT"█S101AS202A01EB02CEA"
460 PRINT"█S101ES202B01E#G02D03C02B":PRINT"█"
470 PRINT"█V7S101AS202A01EA"
480 PRINT"█EA02CEA03CEAS3RT8AS2A"
490 PRINT"█T9S101A"
500 FORA=1TO1500:NEXT
510 PRINT"██████████(-) ¬HRIS |ROENHOUT"
520 END
```

Play Maestro

C. Groenhout,
Watson, ACT 2602

"Prelude" is a direct transposition of J.S. Bach's "Prelude" #1 in C major for the VIC-20 + Super Expander. The program uses the Super Expander's powerful musical generating capabilities starting each musical line with CTRL-back arrow. This produces a reverse capital F. Every ten lines or so, a home is printed so as not to scroll the screen with excessive PRINT statements and lose the credits.

"Fur Elise", by Ludwig Van Beethoven, is here as a greatly shortened and simplified version for Super Expander users. Being only 52 lines long, the program plays this piece with its controversial name changing sound levels when necessary in accordance with the music.

'PRELUDE'

```
10 REM**(C) 1984 BY:**
20 REM*CHRIS GROENHOUT
30 PRINTCHR$(8)+CHR$(14)
40 PRINT"████████████⎍∟⅂⌐‾ IN −":PRINT"██████BY: ⅄.♥.|ACH"
50 PRINT"██████K 1685-1750)"
60 PRINT"█QT2S202V4CEG03CE02G03CE"
70 PRINT"█02CEG03CE02G03CE"
80 PRINT"█02CDA03DF02A03DF"
90 PRINT"█02CDA03DF02A03DF"
100 PRINT"█01B02DG03DF02G03DF"
110 PRINT"█01B02DG03DF02G03DF"
120 PRINT"█02CEG03CE02G03CE"
130 PRINT"█02CEG03CE02G03CE"
140 PRINT"█V602CEA03CA02A03CA"
150 PRINT"█02CEA03CA02A03CA":PRINT"█"
160 PRINT"█02CD#FA03D02#FA03D"
170 PRINT"█02CD#FA03D02#FA03D"
180 PRINT"█01B02DG03DG02G03DG"
190 PRINT"█01B02DG03DG02G03DG"
200 PRINT"█01B02CEG03C02EG03C"
210 PRINT"█01B02CEG03C02EG03C"
220 PRINT"█01A02CEG03C02EG03C"
230 PRINT"█01A02CEG03C02EG03C"
240 PRINT"█01DA02D#F03C02D#F03C"
250 PRINT"█01DA02D#F03C02D#F03C":PRINT"█"
260 PRINT"█V401GB02DGBDGB"
270 PRINT"█01GB02DGBDGB"
280 PRINT"█01G#A02EG03#C02EG03#C"
290 PRINT"█01G#A02EG03#C02EG03#C"
300 PRINT"█01FA02DA03D02DA03D"
310 PRINT"█01FA02DA03D02DA03D"
320 PRINT"█01F#G02DFBDFB"
330 PRINT"█01F#G02DFBDFB"
340 PRINT"█01EG02CG03C02CG03C"
350 PRINT"█01EG02CG03C02CG03C":PRINT"█"
360 PRINT"█01EFA02CF01A02CF"
370 PRINT"█01EFA02CF01A02CF"
380 PRINT"█01DFA02CF01A02CF"
390 PRINT"█01DFA02CF01A02CF"
400 PRINT"█V601S1GS2RDGB02F01GB02F"
410 PRINT"█01S1GS2RDGB02F01GB02F"
420 PRINT"█01CEG02CE01G02CE"
430 PRINT"█01CEG02CE01G02CE"
440 PRINT"█01CG#A02CE01#A02CE"
450 PRINT"█01CG#A02CE01#A02CE":PRINT"█"
460 PRINT"█V301S1FS2RFA02CE01A02CE"
470 PRINT"█01S1FS2RFA02CE01A02CE"
480 PRINT"█01S1#FS2RCA02C#D01A02C#D"
490 PRINT"█01S1#FS2RCA02C#D01A02C#D"
500 PRINT"█01S1#GS2RFB02CD01B02CD"
510 PRINT"█01S1#GS2RFB02CD01B02CD"
520 PRINT"█01S1GS2RFGB02D01GB02D"
530 PRINT"█01S1GS2RFGB02D01GB02D"
540 PRINT"█01S1GS2REG02CE01G02CE"
550 PRINT"█01S1GS2REG02CE01G02CE":PRINT"█"
560 PRINT"█S101GS2RDG02CF01G02CF"
570 PRINT"█S101GS2RDG02CF01G02CF"
580 PRINT"█S101GS2RDGB02F01GB02F"
590 PRINT"█S101GS2RDGB02F01GB02F"
600 PRINT"█S101GS2R#DA02C#F01A02C#F"
610 PRINT"█S101GS2R#DA02C#F01A02C#F"
620 PRINT"█V5S101GS2REG02CG01G02CG"
630 PRINT"█S101GS2REG02CG01G02CG"
640 PRINT"█S101GS2RDG02CF01G02CF"
650 PRINT"█S101GS2RDG02CF01G02CF":PRINT"█"
660 PRINT"█S101GS2RDGB02F01GB02F"
670 PRINT"█S101GS2RDGB02F01GB02F"
680 PRINT"█V4S101CS2RCG#A02E01G#A02E"
690 PRINT"█S101CS2RCG#A02E01G#A02E"
700 PRINT"█T3S101CS2RCFA02CFC01A02C01AFADFD"
710 PRINT"█V6S101CBS202RGB03DFD02B03D02BGBDFED"
720 POKE36876,191:POKE36878,15:FORA=1TO1500:NEXT:FORV=15TO0STEP-.5:
POKE36878,V:NEXT
730 FORA=1TO1000:NEXT
740 PRINT"█████ (−) ¬HRIS |ROENHOUT█"
750 END
```

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Name ....

Signature .... **Date** ....

Address ....

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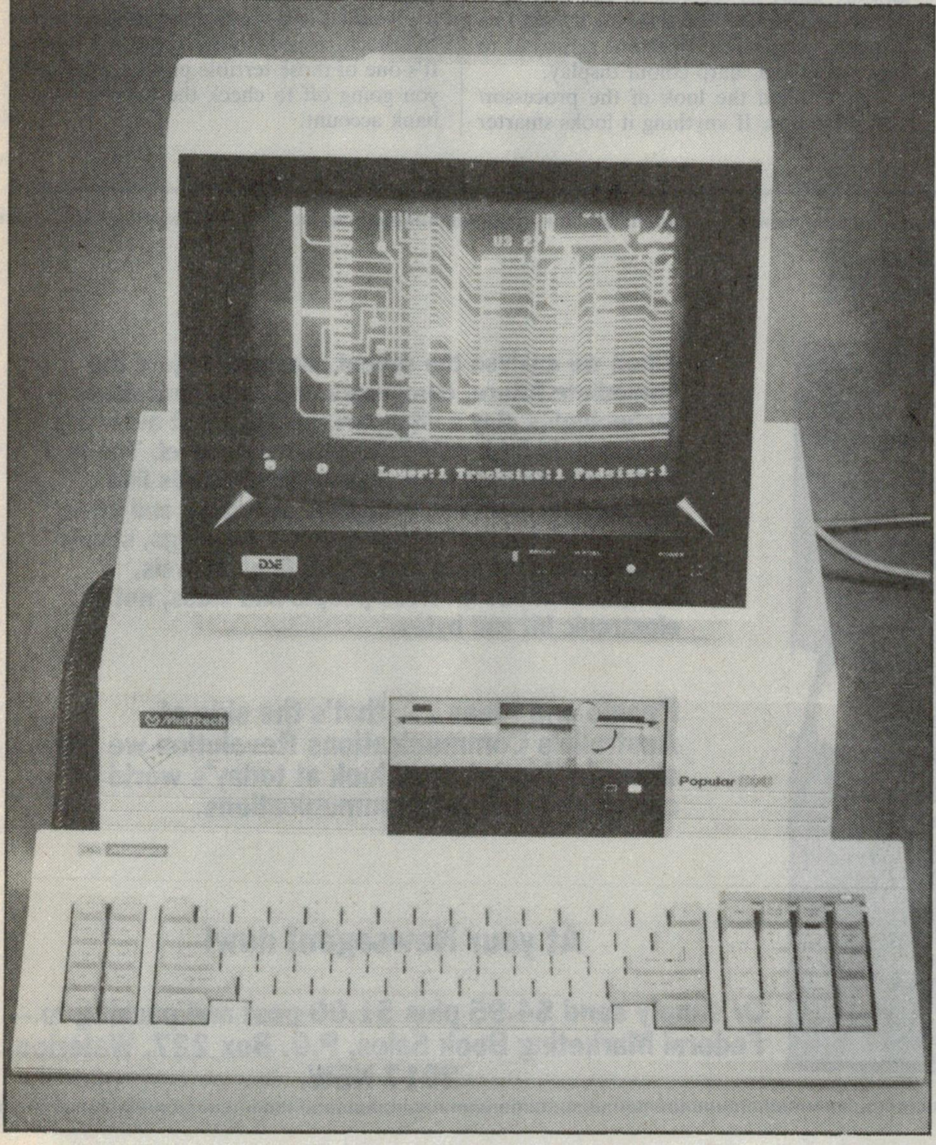
LOW COST IBM COMPATIBILITY

— The DSE Multitech Popular 500



Dick Smith Electronics' venture into business computers has been so successful it even surprised the people at DSE. Now the company has released three computers that run IBM software and bridge the ground between its business and hobbyist users.

David Kelly

SOME YEARS AGO when IBM announced that it would make a personal computer and give it an operating system incompatible with the rest of the industry I thought it was crazy. Changing the attitudes of an entire industry was, I thought, a bit like getting all Australians to drive on the right hand side of the road.

While IBM has not by any means got the market to itself, even the most ardent Apple user would have to agree that IBM has gained an unprecedented level of support from software houses and the makers of complementary or even competing hardware. The only disappointing thing for me and a lot of other hobbyists is that all this activity has gone on at a prohibitive cost.

My interest in computers was sparked in the early seventies when I learned to talk Fortran and other languages on largish IBM and DEC machines. Since that time there have been many microprocessors released that have instruction sets at least equivalent to the machines I learnt on. Few of these have turned up in small computers and the cost of memory, mundane thing that it is, ▶

has made the capabilities of many of these machines totally uninspiring.

Of course IBM compatibility is not the most important criterion for buying a computer; in almost all cases software is! This is as true for the software you write yourself as it is for the off-the-shelf stuff. If the software you really need only resides on a dinosauric computer then that's the one you should buy.

Fortunately for IBM, the cost of memory fell at the right time to make the capabilities of its computers affordable.

What makes this market situation interesting is that a few companies have quite low-cost machines that have varying levels of compatibility with IBM personal computers. Among them are three machines from DSE, the most expensive a 10 megabyte hard disk computer for less than $4000.

DSE's Multitechs

The three personal computers in the DSE Multitech range have prices from $1345 to $3995. The smallest has one floppy drive and 128K bytes of RAM, the next has two drives and 256K of RAM and the biggest has a 10M byte Winchester Drive, a floppy and 512K of RAM. Wordprocessing software comes with the dual floppy drive machine, and an extensive wordprocessing, spreadsheet and graphics package called Aura comes with the top model.

When DSE asked us if we would like to review one of the machines we asked for the top model because we had some pc board CAD software we wanted to try out. With a hard disk drive it was delightfully fast in reading from disk, but in all other respects for most of the software I ran it behaved as either of the other machines would.

I found the hardware, namely the keyboard quite easy to use. I liked its size and the layout of its keys. It didn't have a caps lock light, which I would have liked and I found the keys a bit too light to touch. That might be because I'm used to a steam age manual typewriter, but it is certainly lighter than most keyboards I've used.

The RGB monitor at first sight doesn't look as smart as the rest of the hardware and I was deceived into thinking it would be of moderate quality. In fact it turns out to be a stable and sharp colour display.

I quite liked the look of the processor/disk drive box. If anything it looks smarter than the IBM. Unlike the IBM the processor, I/O, display and hard disk drive cards mount horizontally.

If you buy the hard disk system you will find that all of the motherboard slots are taken up. However the bus is available on an edge connector so if you can supply the power and you know what you're doing, expansion shouldn't be too much of a problem.

Road test

An exhaustive road test of most contemporary personal computers would take months or years. On the Multitech offered for review, I ran the Protel PCB Layout System, the Aura package, Color Wordstar, GW BASIC, Basica and the perennial Flight Simulator.

DSE as yet hasn't offered a BASIC written for the Multitech. I ran scores of the most common BASIC commands without trouble.

Overall I was quite impressed with the Multitech, especially its value for money. It's one of those terrible products that have you going off to check the balance of you bank account. ●

Digital radio trunk system

Telecom has completed the installation of the world's largest digital radio trunk system.

Stretching 5100 km from Perth to Brisbane, this new 'superhighway' will carry large volumes of traffic — voice, data, text, sound and television — with high reliability.

Known as a 140 megabit per second system, it can accommodate up to six radio bearers each of which could carry the equivalent of almost 2000 simultaneous telephone conversations or a number of television relays.

The route follows the microwave radio system linking Perth, Adelaide, Melbourne, Sydney and Brisbane. New antennas and electronic equipment were installed at the capital city terminals and at the 120 repeater stations along the route.

Installation costs totalled $73 million and include duplicated power systems, and remote supervision and control facilities. Each 'hop' has a protection radio bearer which is automatically switched into use should a fault develop on a main bearer.

Special high performance antennas and radio circuitry were used to eliminate interference and overcome fading of the radio signals.

Telecom's General Manager, Network Engineering, Mr Bob McKinnon said that the installation of the system was a significant engineering achievement. "Australia is well up with other leading countries in this move towards modern digital systems.

"All the new electronic telephone exchanges we are installing are digital and we have a joint venture with a manufacturer to produce the world's first small digital rural telephone exchange. Our next step is to complement this system by linking the capitals and major centres such as Darwin with an optical fibre trunk system by 1990. This will give Australia a digital network of great route diversity and high reliability.

"Work has already started on the Sydney-Melbourne optical fibre link", Mr McKinnon said, "our aim is to have it in service on Australia Day 1988".

Electronic communications explained

The word "informatics" might sound a novel coining but it is established enough to be listed in the *Macquarie:* "a discipline of science which investigates the structures and properties of scientific information as opposed to the content". That rather abstract and elusive definition is given a much wider and more concrete interpretation in a new publication *Be Part of Australia's Communications Revolution*, which invites the public to study informatics by becoming aware of what's around in communications technology and what the social implications of this technology are.

The publication is a comprehensive and pragmatic treatment of recent developments in electronic communications. It covers the fairly familiar territory of modems, communications software, FAX, satellites, teletext and videotex, and networking, for example, with discussions of standards and the newer (at least to Australia) technologies such as electronic mail systems and cellular radio — all from the user's point of view.

It is the discussion of the application or usability of these facilities that really gives the book its edge, particularly in its concentration on business use. So the treatment covers the use of teleconferencing (including video conferencing and computer conferencing) and electronic mail systems as channels of communication within a single business centre or its branches, or between interested individuals, perhaps in a seminar, etc.

Placing these communications techniques in the business context gives a picture complete with economics and psychological practicalities that the less imaginative among us can use as a solid departure point for assessing advantages and disadvantages, whether we agree with the author or not. The use of these communications techniques in industry is, of course, particularly important as developments usually ride on industry.

The book is probably most valuable for its systematic description (or cataloguing) of the sorts of technology and hardware available, what it does and how people use it to benefit, and for its resume of available data bases, videotex and teletext information, and charges. It provides some guiding questions to ask of the device or package you might be interested in and evaluates products and systems in the present Australian situation. Rather briefly, the book outlines a bit of the science involved in both the new technologies like cellular radio and the old standards (like BMAC), however, it never loses its practical thrust which makes it a handy reference for the interested user rather than the technologist.

Be Part of Australia's Communications Revolution is available from newsagencies for $4.95 or from the Federal Publishing Co, 140 Joynton Ave, Waterloo, NSW 2017 for $4.95 plus $1 p&p.

NT served by shortwave

In the past the isolated areas of the Northern Territory have received their radio entertainment from three small mediumwave stations at Alice Springs, Tennant Creek and Katherine and on shortwave from Radio Australia. All this has now changed with the installation of three 50,000 watt SW transmitters at these sites, to ensure excellent reception of the ABC programmes.

The idea was mooted some 20 years ago with the programmes being fed from Darwin, but in 1975 when Cyclone Tracey struck the Darwin area the project had to be cancelled, and those three transmitters on order for the new NT service were resited at Carnarvon and Shepparton.

The new plan includes a specialised type of aerial, a vertical incidence of a log periodic design, specifically constructed for this type of transmission, as the aim of the station is to lay down a strong signal in a restricted area.

The idea is to provide a signal from these transmitters which will be relatively clean in the service area, and will not suffer from distortion as can be the case in this type of transmission. The basic transmission pattern is that the lower frequencies will be used during the hours of darkness and the higher frequencies during daylight; at the present time only the 60 and 120 metre bands are being used. Due to the low sunspot activity, these frequencies are in operation but the transmitters can move up as high as the 19 metre band when transmission conditions improve.

The transmitters will be unattended, and will be linked to the Darwin transmitting site on Cox Peninsula, the site of Radio Australia's high powered transmitters. Facilities have been provided to take over any programme failure and the operation of the three transmitters is controlled by its own microprocessor system.

The Alice Springs station has the call sign VL8A and uses 2310 kHz 0700-2230 UTC and 4835 kHz 2230-0700 UTC. The station at Tennant Creek has the call sign VL8T and operates on 2325 kHz and 4910 kHz and from Katherine broadcasts will be on VL8K 2485 and 5025 kHz. In the case of the latter two stations, the tentative plan is for the lower frequency to be operating 0700-2230 UTC and the higher channel 2230-0700 UTC.

— **Arthur Cushen**

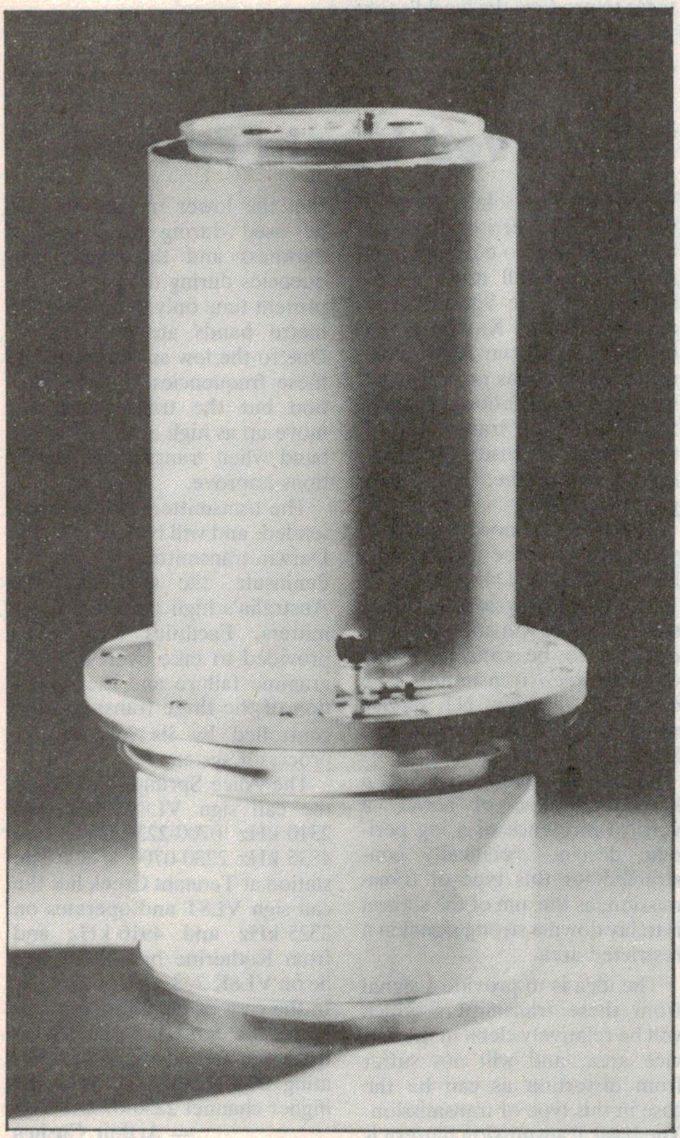
New tube for Marconi transmitter

The new YL1660 500 kW tube from Philips Elcoma has just gone into full production, following the successful completion of trials at the BBC's Rampisham transmitter station.

Philips, the BBC and Marconi Communication Systems of Chelmsford, UK, conducted joint trials during which the tube was fitted into the existing socket of Sender No 48 — a Marconi B6127 at Rampisham in the UK. The tube underwent the full range of transmitter functions, from start up to full operation and frequency changing, and successfully delivered its full rated output power. Unlike many comparable tubes, no black-heat switch-on procedure is required. This reduces costs as less power is needed.

Philips is the second manufacturer to have a tube accepted by Marconi for its 500 kW transmitter. This is the first time such a high-power transmitter has had two different sources for its output valve.

For further information contact **Philips Electronic Components and Materials (02)439-3322.**



Telecom's ISDN plans announced

Telecom is planning to introduce the first stage of its Integrated Service Digital Network (ISDN) over the next three years.

Mel Ward, Telecom's chief general manager described it as an exciting step forward in telecommunications. "Over the past decade we have been developing our digital switching and transmission capacity and we now have a digital network as modern as any in the world.

"The next step — ISDN — is to transform this network into one which will not only carry voice traffic, but all forms of data, text and image. This will mean that one single 'pipeline' into the network can accommodate a variety of terminal equipment and give a wide range of services.

"It represents the real convergence of computer and telecommunications technologies," Mr Ward said. "Initially it will carry traffic at speeds of up to 64 kilobits per second and enable information systems like Viatel to use high speed colour of photographic quality. It could pave the way for colour facsimile transmissions."

Mr Ward said that the first step would be to offer ISDN service in each mainland capital, giving access to business customers with modern PABXs.

KILOHERTZ COMMENT

AUSTRALIA: Radio Australia's "Talkback" programme which is now hosted by Brendon Telfer and contains information for those interested in radio communications, has been retimed. Broadcasts are now Friday 1610 UTC, Saturday 0310, 0810 and 1240 UTC. The session contains a weekly report on propagation conditions and a look at future prospects on the higher frequencies.

CANADA: Radio Canada's "Shortwave Digest" is now heard at 0405 UTC on Monday on 9755 kHz. The session is conducted by Ian McFarland and includes a weekly round-up of news on station schedule changes and new frequencies observed in North America. A session more suited for Australian reception is broadcast on Saturday 2130 UTC on 11945, 15325 and 17875 kHz.

ECUADOR: HCJB broadcasts "DX Party Line" three times each week, and compere John Beck is heard on Monday 0930, Wednesday 0700, and Saturday 0930 UTC. The transmissions to the South Pacific of this 30 minute feature are carried on 6130, 9745 and 11925 kHz. "DX Party Line" includes a report from the South Pacific on the third Monday of each month, while on the fourth Monday information on the South Pacific Association of Radio Clubs is featured.

GUAM: Station KTWR "DX Listeners Log" has been retimed to Saturday 0800-0815 UTC and is now on 15115 kHz. This programme also features a report from the South Pacific on the third Saturday, and an SPARC news release on the fourth Saturday of each month.

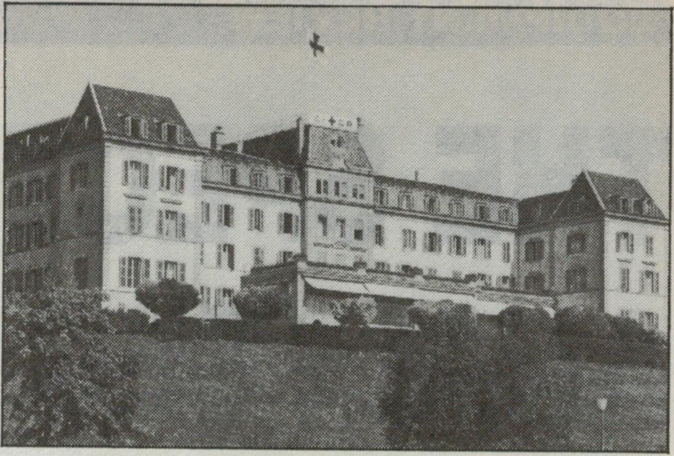
NEDERLAND: Radio Nederland "Media Network" programme is now heard at the earlier time of 0450 UTC on Thursday on 9895 kHz. The broadcasts for the South Pacific are carried at 0750 UTC on 9630 and 9715 kHz and again at 1050 UTC on 9650 kHz. The session is compered by Jonathan Marks and includes a report from New Zealand on the first Thursday of each month.

SWEDEN: Radio Sweden has a transmission to Australia in English at 1100 UTC on 15115 kHz and the session on Tuesday includes "Sweden Calling DXers". A new transmission 0400-0430 UTC on 9665 and 9695 kHz, also has the DX programme during the Wednesday broadcast.

UNITED KINGDOM: The popular BBC session Waveguide has been retimed and is now broadcast to the Pacific on Sunday 0745 UTC with 7150, 9510 and 9640 kHz giving the best reception. The programme is repeated Tuesday 1115, Wednesday 0430, and Thursday 0130 UTC. The session is designed to help listeners hear the BBC World Service better, and also includes schedule changes with receiver reviews and tips on improving reception through the use of more efficient aerials.

This item was contributed by Arthur Cushen, 212 Earn St, Invercargill, New Zealand, who would be pleased to supply additional information on medium and shortwave listening. All times quoted are UTC (GMT) which is 10 hours behind Australian Eastern Standard Time; areas observing Daylight Time should add a further hour to these schedules.

Red Cross radio in world trouble spots



The International Committee of the Red Cross broadcasting centre in Geneva.

The Red Cross radio conducts regular tests on its frequency as a precautionary measure to ensure that in the event of any major disasters communication is available from Geneva to ICRC staff in outlying areas.

The Red Cross had its beginnings in Italy in 1859 during the war between Italy and Austria when a young Swiss, Henry Dunant, was moved to action by the ghastly plight of the wounded. Henry Dunant improvised relief for them with the assistance of the local population. Following this five men met in Geneva in 1863 and decided to create what is now the ICRC. In 1864 the first convention was adopted, a red cross on a white background.

During World War II the ICRC first found that radio was a tremendous tool in the work of linking the missing with their next of kin, and broadcasting lists of prisoners of war and civilian internees. The success of this service resulted in the unique distinction for the Red Cross of a frequency being allocated permanently for its radio broadcasts.

In 1948 the ICRC was granted the use of a frequency in time of major crisis, and then began test transmissions on the frequency of 7210 kHz using the technical facilities of the Swiss Post & Telegraphs which also provide Swiss Radio International with the studio and transmitters used today. The Red Cross Radio has its own studio in Geneva; broadcasting facilities are provided free of charge by the Swiss PTT and Swiss Radio International. The programmes (in English, French, German, Spanish, Portuguese and Arabic) give news of Red Cross action around the world.

Over the past few months Red Cross Radio has increased its bimonthly tests on 7210 kHz which are mainly for Europe. Broadcasts in English are on the last Sunday of each month 1100-1130 UTC, and the following Monday 1700-1730 UTC.

Transmissions over Swiss Radio International to Australia are at 0740-0757 UTC on 9560, 15305, 15570 and 17830 kHz. These broadcasts are on the last Monday of each month, and the following Thursday.

— Arthur Cushen

DOC news

A report commissioned earlier this year by the Department of Communications has **warned against selling off profitable aspects of the operations of Telecom and OTC.** It also says Australia should reject any proposals from private international satellite companies for direct access to Australian users.

Australia should also look at ways in which its Aussat satellite system could provide coverage to the South-west Pacific and South-east Asian regions, the report says.

These and other recommendations are contained in a report entitled *Transborder Data Flow and International Trade in Electronic Information Services: an Australian Perspective,* by Dr John Langdale, a senior lecturer in geography at Macquarie University.

Mr Michael Duffy has announced that the Government has taken the first step towards achieving the **equalisation and aggregation of regional commercial television** by agreeing in principle to the upgrading of facilities at many of the Commonwealth's multi-purpose transmitting stations in regional areas of Australia — an essential step if its broadcasting objectives were to be met.

The Minister said these objectives included the expansion of commercial television services in regional Australia through equalisation (three commercial services in regional areas), development of commercial FM radio and the provision of a second regional radio network for the ABC.

The Illawarra television operator, **WIN-4, has been informed that it would be required to move to the UHF** band within three years.

The Minister says it forms part of the Government's plan to bring more commercial television services to regional Australia.

In the specific case of WIN-4, the move to UHF had to be made because the station, by its presence on VHF channel 4, was blocking further development of FM radio services in the region.

Two new proposed local commercial services will transmit on the VHF band along with SBS and part of the ABC service. The ABC will move totally to UHF, making Wollongong a UHF-only city.

A Department of Communications spokesman has appealed to **farmers across Australia to ensure all their two-way radio equipment is licensed** so that any threat of interference to other services is averted.

The spokesman warned that under the *Radiocommunications Act 1983* penalties for unlicensed use of radio equipment include confiscation of equipment and a fine of up to $2000, or imprisonment for a maximum of twelve months.

A prominent National Party spokesman has described claims that a **coalition Government would sell Telecom** as "alarmist and untrue". Mr Bruce Lloyd, spoke of Telecom as "the key safeguard for country people".

This puts Mr Lloyd squarely at odds with Opposition Leader John Howard, and the Opposition spokesman on Treasury matters, Mr Jim Carlton.

DOC Minister Duffy reaffirmed the figure of $490 million as the estimated value of the cross-subsidisation from profit making services to loss making services in Telecom in 1984-85, a matter vitally affecting country people.

Work on **installing new earth stations in remote communities** to tap into Aussat television transmissions is gathering momentum the DOC Minister has noted. Special decoders being used in the program are under manufacture in Toronto, Canada, and will be tested at the DOC's lab in Canberra before being despatched to the outback sites. In all, 61 new earth stations are to be installed.

The Government has decided to **waive sales tax on earth stations for domestic use** bought to receive satellite radio and television services from Aussat. The Minister has predicted the benefit to country people should be at least $500.

The cost of each station, as already indicated by distributors, ranges from $2250 (excluding sales tax) for a 1.5 metre diameter dish. Exact prices would be subject to usual market place negotiations between seller and buyer.

THE SPECTRUM ANALYSER EXPOSED

IT WAS WITH some tepidation that I asked the editor "why not review a spectrum analyser?", a caution not out of place as spectrum analysers have been surrounded by some doubtful mystery in the technical world. They do not lie thick on the benches of labs or service departments. Even today, the price of models goes well into five figures, so it is not surprising that they are few and far between, with the result that design engineers are almost the only users.

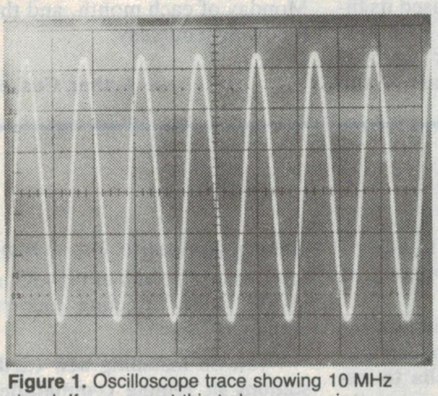


Figure 1. Oscilloscope trace showing 10 MHz signal. If you expect this to be a pure sine wave then see Figure 2.

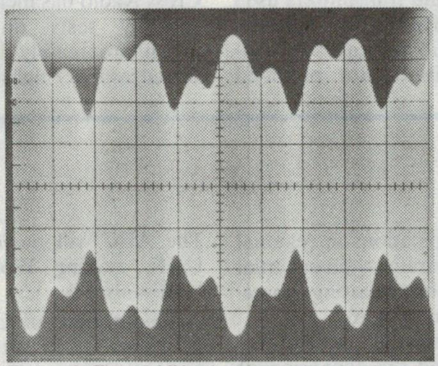


Figure 3. The 10 MHz signal modulated with audio tones of approximately 1.5 and 2.5 kHz. Frequency components are impossible to recognise, when viewed on an oscilloscope.

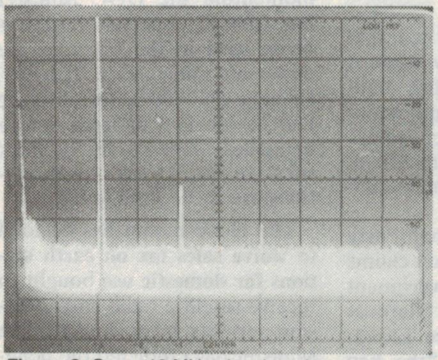


Figure 2. Same 10 MHz signal on the spectrum analyser shows that signal, thought to be a pure sine wave, has harmonics. Analyser dispersion is set at 5 MHz/div and shows first and second harmonics at 20 and 40 MHz. The fundamental (10 MHz) is set to top of screen and the relative amplitudes of the harmonics, referenced to the signal are seen to be 40 dB and 50 dB below the signal.

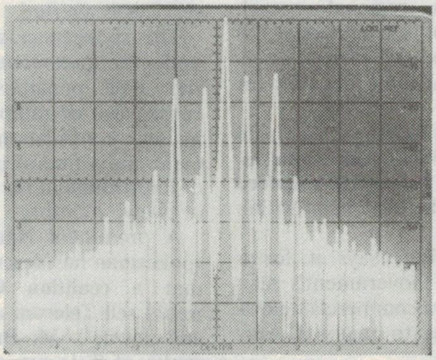


Figure 4. The same amplitude modulated signal on the analyser, set so that resolution shows 2 kHz per division. The two audio sidebands can be seen above and below the carrier frequency. Also notice additional lower level sidebands possibly caused by intermodulation or harmonics from the audio frequencies also modulating the 10 MHz signal. Obviously a spectrum analyser would be useful for further investigation if this was an unexpected development!

To allow lower orders of technical staff to use a spectrum analyser used to be standard heresy. The secrets of this 'black box' were literally kept under wraps by management nervous about unknowing hands wrecking the instrument.

Today the picture isn't so grim and spectrum analysers are finding a role alongside more commonly used instruments such as the CRO and signal generator.

Hertz history

First, a definition. A spectrum analyser is like an oscilloscope in that both present, via a CRT screen, a graphical representation of an electrical signal. The oscilloscope is used to look at signals in the time domain, which is a technical way of saying amplitude as a function of time.

The spectrum analyser allows you to look at signals in the frequency domain, which simply means that the amplitude is looked at as a function of frequency. Maybe a diagram or two will show you the difference. The familiar pure sine wave display on the screen of an oscilloscope is shown in Figure 1. The display shows the amplitude (measured in volts) as a function of the time base selected.

The same signal displayed on a spectrum analyser looks like that in Figure 2.

Instead of the base line representing time, the spectrum analyser base line is calibrated in terms of frequency. Thus, each vertical line may represent an interval of 2 MHz, which means in our example we are looking at a 10 MHz signal with a certain amplitude — not usually measured in volts but in power (dBm).

The capacity of the spectrum analyser to look at discrete frequencies is valuable when more complex signals are involved. Figure 3 shows a more complex signal displayed on the oscilloscope, which I will describe as multitone amplitude modulation of an rf carrier. The frequency components of the signal are summed together and are impossible to separate, as you can see.

The same signal displayed on a spectrum analyser would appear as in Figure 4. This shows the carrier as well as the two modu-

Bringing the spectrum analyser out of the closet and on to the bench! If you work with rf, this attractive tool is now available at affordable prices.

Peter D. Williams

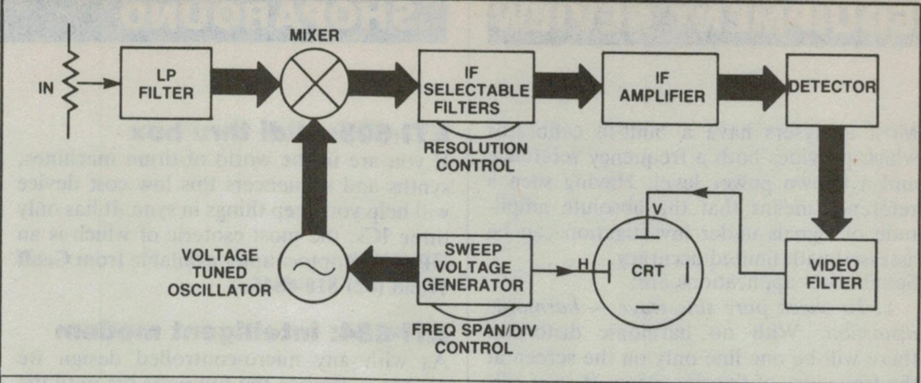


Figure 5. Block diagram of the operation of a spectrum analyser.

lating frequencies. The other important feature that can be seen from all this is the percentage level of modulation of each of the two tones. One might ask, why, when there are only two tones modulating, you can see the carrier in the centre and two frequencies each side. The answer is that AM or amplitude modulation gives a sum and difference product so the spectrum analyser looks at what is produced above and below the carrier frequency.

One of the major differences between the oscilloscope and a spectrum analyser is the frequency at which each can operate: an oscilloscope capable of operating above 400 MHz is an extremely rare device, whereas spectrum analysers are available to look at signals up to and beyond 40 gigahertz. But it is important to emphasise that spectrum analysers do not replace oscilloscopes; rather their advantage lies in gathering information in the frequency domain.

How does it work?

Very simply, a spectrum analyser is a narrow bandwidth, superheterodyne receiver which can be electronically tuned in frequency. The detector output is coupled to the vertical display of the CRT and the sweep generator providing the electronic tuning is coupled to the horizontal display. A simplified block diagram looks something like Figure 5.

The spectrum analyser has different controls from the CRO. FREQUENCY SPAN or FREQUENCY SPAN/DIVISION, together with FREQUENCY, are two functions to be found on the front panel. RESOLUTION (or RESOLUTION BANDWIDTH) may not be immediately obvious, as it is usually coupled or locked to other interrelated controls.

As a receiver, the spectrum analyser is subject to the same 'ills' that any receiver might have designed into it and precautions have to be taken to minimise images and intermodulation effects; you have to pay attention to good dynamic range, noise figures and sensitivity.

In operation, the signal requiring investigation is passed to the mixer after being reduced to a suitable level. The bane of the spectrum-analyser-keeper is the ever present possibility of accidentally feeding a transmitter output into the front end. Repairing the damage is always expensive and the perpetrator often finds himself in the job market! The attenuator is designed to reduce signal level, but will not act as a fuse!

The lowpass filter minimises the analyser's IF image response and after mixing with the signal from the VCO (voltage controlled oscillator), the signal passes through the IF filter. This filter's bandwidth is adjustable and determines the resolution of the analyser.

'Resolution' simply means the ability of the analyser to separate signals for closer examination. Very high resolutions of 10 Hz or bandwidths of 300 kHz can be found in low frequency analysers operating up to 120 MHz. Very expensive analysers covering up to 20 GHz may have small bandwidths too. If a bandwidth of 10 Hz is selected, it should be possible to resolve and see displayed on the screen, signals that are 10 Hz apart — but not without difficulty and the ability to do this is a function of analyser design and operator technique.

The resolved signal then passes through the IF amplifier where it may have its amplitude controlled in exactly the same way as it would in a communications receiver. The detector then applies the signal to the vertical plates of the CRT — the stronger the input signal, the greater the vertical deflection.

The video filter serves the purpose of enhancing the display especially when signals are of low level and near the level of internally generated noise or 'grass'.

Since one may not want to sweep the full range of frequencies that the analyser is capable of receiving, some means is employed to control the sweep range or dispersion. This is the frequency control span mentioned earlier. Usually there are three modes employed. Full scan or full span are used where the complete spectrum is displayed, and in the case of the Anritsu we are reviewing (see page 101) this would show any signals in the complete range of 0 to 2 GHz. This position is used when trying to locate signals.

Alternatively, when the wanted signal has been located, the frequency per division mode (10 divisions on the Anritsu) is employed. This means that the span control can narrow the scan range over the screen so that the vertical lines on the graticule represent 10 MHz, 1 MHz, 10 kHz, or even 1 kHz for each division. Thus, it is possible to 'zero in' or focus on a particular signal.

For example you might want to see if there is any noise on the sidebands of an oscillator, or whether there are frequency modulation or other instabilities present. This technique is employed in analysis of defence radar signals; it is possible to analyse the pulses to estimate the type of equipment being used. Klystrons and other high power radar generators have 'finger prints' of their own.

The third mode that can be employed is zero-scan, when the analyser becomes a fixed tune receiver with the selectable bandwidths that I mentioned earlier — quite useful for real time analysis of a single signal.

Of course the selected signal can be tuned to the centre of the screen when the analyser is in any of the scan range positions and a tuning control shows the frequency that the centre of the screen represents. Some analysers have mechanical numeric indication; others have digital LED readouts or a slide rule with pointer indications.

These features are to be found on almost all spectrum analysers. Variations on the theme, especially with higher priced units, can give you digital display, storage, control and readout with the use of controllers and an instrumentation interface bus.

Using the analyser

The spectrum analyser does nothing more than its title suggests: it analyses signals. The most frequent use for the analyser is to determine *relative* amplitude and *relative* frequency.

The vertical divisions usually represent 10 dB steps, although 2 dB per division can be used. Linear steps are usually in volts. ▶

Most analysers have a built-in calibrator which provides both a frequency reference and a known power level. Having such a reference means that the absolute amplitude of signals under investigation can be assessed with limited accuracy.

Some other applications are:

1. *To check pure sine wave — harmonic distortion.* With no harmonic distortion there will be one line only on the screen at the frequency of the sine wave. If an rf carrier contains frequencies other than the wanted one, the levels and frequencies will be shown on the analyser.

2. *Amplitude modulation.* Not only is the carrier displayed but also sidebands at a distance from the carrier equal to the modulation frequency. Additionally the power in the sidebands is dependent on the percentage of modulation so that if you have 100 per cent modulation, you will see that each sideband is 6 dB below the carrier, ie, 50% power in sidebands. This is quite a convenient way to check a modulation meter — at least at full scale.

3. *Frequency modulation.* Frequency modulation produces sidebands that are centred around the carrier as in AM except that more than one sideband is generated, and all are multiples of the modulating frequency.

4. *Field strength.* Of increasing concern today is the compatibility of electronic equipment. Electromagnetic interference has been the subject of recent seminars in Australia. Unwanted radiation from systems can be rapidly detected with the spectrum analyser and if engineering is done to effect improvements, any changes can be readily seen.

5. *Transmitter testing.* When testing sideband transmitters, intermodulation distortion levels can be readily seen. SSB transmitters and amplifiers must be linear and the appropriate two audio tones fed to the transmitter and viewed on the screen can indicate how linear or clean the signal will be.

In evaluating signal generators two features should be considered.

Dynamic Range. A practical definition limits the maximum and minimum levels to those that can be simultaneously observed on the screen. A 100 dB display range would be considered very good. Most are 80 dB but 'grass' reduces this. This limitation at the low end is the sensitivity of the analyser and at the top end one might call it the 'burn out' specification. Usually spectrum analysers can accept a +13 dBm power level without damage. However, it is not possible to display the complete range at the same setting.

Stability. A spectrum analyser is not usually as stable as a good signal generator. A drift of less than 50 kHz per 10 minutes is very good.

●

SHOPAROUND

ETI-609: Midi thru box

If you are in the world of drum machines, synths and sequencers this low cost device will help you keep things in sync. It has only three ICs, the most esoteric of which is an HP 6N138 optocoupler available from **Geoff Wood (02) 810-6845.**

ETI-684: Intelligent modem

As with any micro-controlled design we cannot guarantee the full parts list until the last line of software has been proven with the hardware. We intended to have the full design published by now, but we are not willing to do so if there is a chance a part or the pc board may change. To get things started we have published the intelligent power supply for the intelligent modem. We won't actively chase kit suppliers until we can give them a full and reliable parts list.

ETI-697: Simple Forth board controller

The relevant pc board and IC are available from **Energy Control**, see offer page 66.

ETI-171: Arbitrary waveform generator

The ability of this instrument to generate standard or arbitrary waveforms has until now only been found in instruments worth thousands of dollars. Last month's project 171 can be programmed with toggle switches, by entering waveform slopes or from the parallel bus of your computer. At the time of writing **All Electronic Components in Melbourne (03) 662-3506** was getting a kit together. **Rod Irving Electronics (03) 543-7877** has all the ICs and **Jaycar** is ordering in the ones it doesn't have in stock. **Dick Smith** has the National Semiconductor DAC800.

ETI-1530: Vibration detector

This project from last month is surprisingly simple and surprisingly useful, especially if you are bothered by rattles and other gremlins in things mechanical. It can be used on cars, electronic equipment, even plumbing. The key to the detector is the use of a multimeter probe to transmit vibrations. **All Electronic Components** will have a complete kit. The parts are very garden variety, though the pcb will have to be bought from **RCS Radio in Sydney (02) 587-3491.**

Artwork

For those willing and able to make their own pc boards and/or front panels, we can supply same size film transparencies of the artwork, positives or negatives as required. If this art is not reproduced in the magazine because of space we will supply a photocopy free if you send us a stamped envelope. From the list given below, select what you want and address your request/order to:

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When ordering, make sure you specify positives or negatives, according to the process you use. Your cheque or money order should be made payable to ETI Artwork Sales. Prices for the artwork for these project are:

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FOR SALE: REALISTIC MINI stereo amplifier. SA-150. Cat no 31-1955, unused $80 ono. Ph Ted (02)331-2872, 12 Leichhardt St, Darlinghurst, NSW 2010.

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FOR SALE: VIC-20 programme library. High quality games, utilities, educational and misc programmes available. Send SAE to Chris Groenhout, 25 Kerferd St, Watson ACT 2602, for list.

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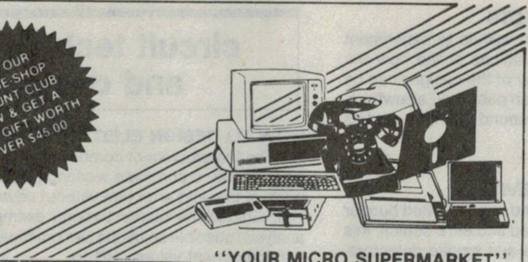

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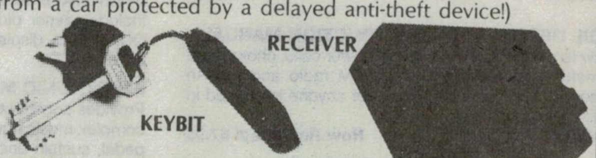

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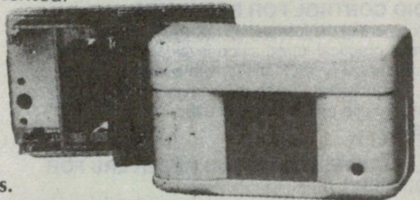

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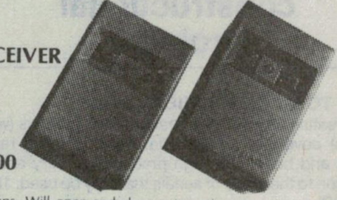

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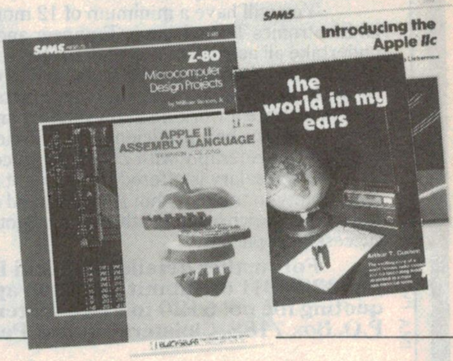

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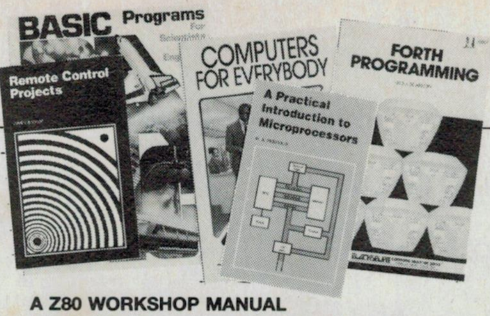

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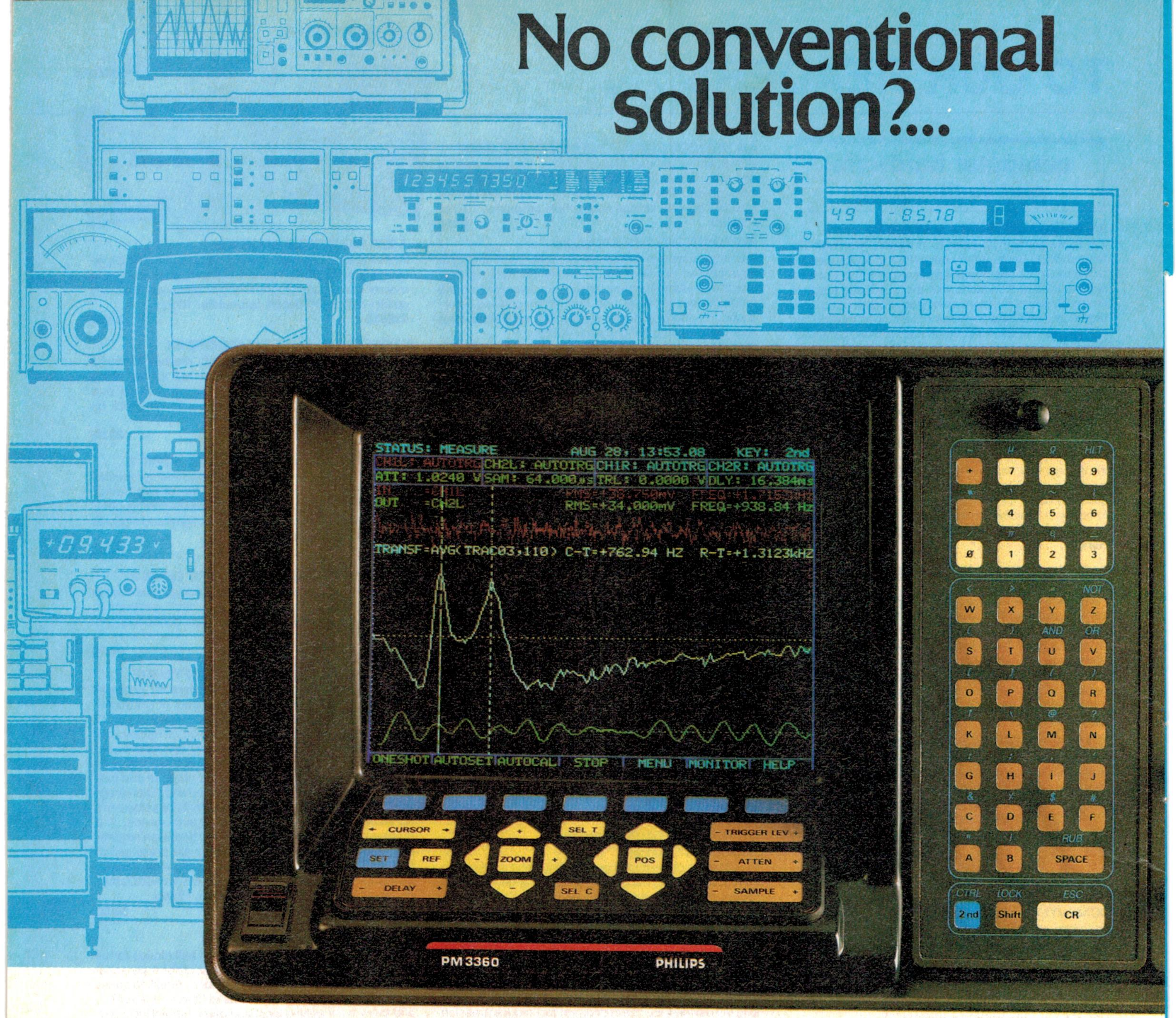

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UNDER ANALYSIS —Anritsu MS610A spectrum analyser

A versatile, 8085 processor controlled tool, the Anritsu MS610A spectrum analyser looks like one of the best lab buys around. It's easy to operate with a fine range of frequencies for a reasonable price.

Peter D. Williams

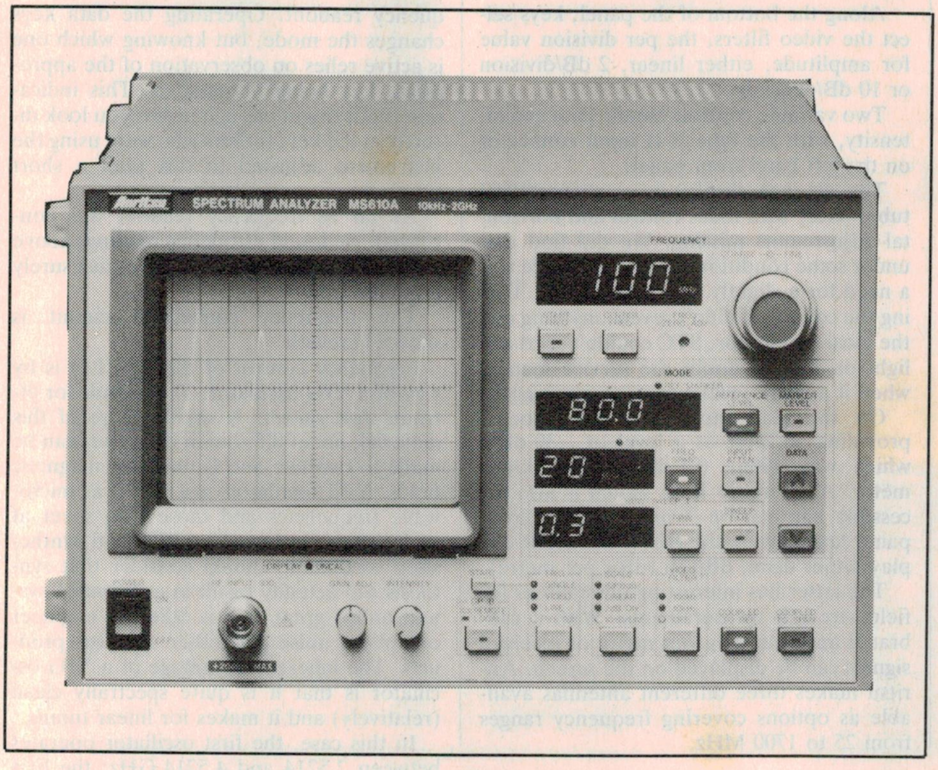
THE SPECTRUM ANALYSER must now be considered as an everyday test instrument, even in smaller service organisations, and a must in all production enterprises charged with radio frequency engineering and maintenance.

The background and capabilities of such an instrument have been covered elsewhere in this issue (see page 94) and when the opportunity came to test a Japanese version, we jumped to see how our northern technologists plan to attack the strongholds of HP and Tektronix. Priced at under $10,000 (exchange rates notwithstanding) this instrument must be considered seriously.

The Anritsu analyser covers from 10 kHz to 2 GHz and comes from a well known and technically able Japanese company, as the lowest priced instrument in its range.

Features

The frequency coverage is ideal. With a response to 2 GHz, transmitter harmonics and spurious signals can be readily observed. Other 'spectrum monitors' in the market place, especially those in combination type instruments, seeming to check out at 1 GHz, make no allowance for checking cellular radio transmitters and some microwave systems. Such radio telephones will operate around 800 MHz and it is useful to be able to look at first harmonics. Other two-way services are moving higher in frequency too, and one suspects that an upper limit of 2 GHz may need to be increased in a year or so.



For those unfamiliar with hands on operation of spectrum analysers, it would be useful to review what to look for if ease of operation is to be a consideration. A large percentage of your time is going to be involved in searching for signals and assessing their relative amplitude.

The three simple procedures are as follows:

1. Tune to the signal to be measured.
2. Zoom in on the signal to be measured by decreasing the frequency span.
3. Operate the attenuator control (gain) to put the signal at the top of the screen and read its amplitude in dBm.

You will also have to ensure that as the bandwidth and frequency span is reduced, so is the sweep time. As bandwidths are reduced, the band pass filters must have time to respond or amplitude calibration will be lost.

Any respectable analyser has the ability to couple the frequency span, the resolution bandwidth and sweep time so that optimum values are selected and the Anritsu MS610A does this very well.

Looking at top right hand side of the MS610A, the frequency tuning knob is a concentric control with the outer knob for coarse tuning and the inner dial for fine tuning. The four-digit LED display shows the frequency with a 1 MHz resolution. Immediately below the display are two pushbuttons which put the dialled signal display ▶

TABLE 1. OPTIMUM SETTINGS

FREQUENCY SPAN	RESOLUTION BANDWIDTH (RBW)	SWEEP TIME VIDEO FILTER OFF	SWEEP TIME VIDEO FILTER 10 kHz
2 GHz	300 kHz	0.1 s	2.0 s
1 GHz	100 kHz	0.2 s	2.0 s
0.5 GHz	100 kHz	0.1 s	1.0 s
0.2 GHz	100 kHz	0.1 s	0.5 s
0.1 GHz	30 kHz	0.2 s	1.0 s
50 MHz	30 kHz	0.1 s	0.5 s
20 MHz	30 kHz	0.1 s	0.2 s
10 MHz	10 kHz	0.2 s	0.2 s
5 MHz	10 kHz	0.1 s	0.1 s
2 MHz	10 kHz	0.1 s	0.1 s
1 MHz	3 kHz	0.2 s	0.2 s
500 kHz	3 kHz	0.1 s	0.1 s
200 kHz	3 kHz	0.1 s	0.1 s
100 kHz	1 kHz	0.2 s	0.2 s
0	30 kHz	0.1 s	0.1 s

at the start or at the centre of the screen. Each key is illuminated, if its function is active, with a built-in LED. It is usual to put the frequency in the centre as frequency or modulation components may show up either side of the signal under investigation, such as with AM.

The pushbuttons are colour coded for easy identification — blue buttons for mode, green for a function controls, orange for the parameter and white for data.

Below the frequency group the mode group of controls with data keys does most of the business you want from an analyser.

The digital display in this panel shows the reference level which is the value of the level selected at the top of the screen, either as dBm or dBμ, or, if the LEVEL is depressed, a section at the top of a trace is brightened and the actual value of the trace peak amplitude is then shown on the display. This is a very useful parameter to have displayed as you can not only take a value reading from the screen, but get additional verification from the digital display.

Immediately below the REF and marker keys are the FREQUENCY SPAN and INPUT ATTENUATOR controls with their LED displays. Further down is a row covering the RBW (resolution bandwidth) and sweep time. Two data keys on the extreme right hand panel are used to increment or decrement any of the parameters of frequency span, reference level resolution bandwidth, input attenuator or sweep time.

The MS610A couples frequency span, bandwidth, and sweep time with the keys COUPLED TO REFERENCE and COUPLED TO SPAN. Thus, when using the couple functions all you have to do is set the REFERENCE LEVEL and FREQ SPAN and all other measuring conditions are set at their optimum values. This includes the attenuator which ensures that the incoming signal has a level no greater than −30 dBm at the mixer for good intermodulation performance.

Table 1 shows the optimum settings for each of the parameters and also serves the added purpose of outlining the resolution bandwidths that can be selected, and the frequency span available on the analyser. It is also possible to put the analyser into the uncoupled condition by depressing the function setting keys. When this is done, the DISPLAY UNCALIBRATED light might illuminate (located right under the CRT graticule) if incorrect combinations of RBW and sweep are selected. It is then possible to operate the DATA keys to select bandwidths and frequency spans to suit particular requirements. Repressing both COUPLED keys restores the analyser to the preordained condition.

When viewing the frequency span on the digital display, it should be kept in mind that the figures show the full width of the screen as being the frequency span. Other manufacturers show vertical graticules as so many MHz per division. For example, in Table 1, the 1 GHz frequency span could be shown as 100 MHz/division.

Along the bottom of the panel, keys select the video filters, the per division value for amplitude, either linear, 2 dB/division or 10 dB/division.

Two variable controls handle gain and intensity, with the type N rf input connector on the left hand front panel.

The six-inch display is a conventional tube, oddly with focus control and horizontal adjustments missing. We did find that under some conditions of display, there was a need for a slightly finer trace focus. Taking the covers off didn't reveal anything and the local distributor, STC couldn't shed any light on it. (No doubt the service manual when it appears, will explain everything.)

On the rear panel is a BNC socket providing 50 MHz at a level of −30 dBm which was within 0.1 dB of our power meter. A reference level switch is also accessible and can be switched so the front panel can show on the REF/MARKER display either dBm, dBμ/m (dBμ per metre).

The latter has interesting possibilities for field strength measurements. With a calibrated antenna, dBμ per metre of received signals can be displayed on the screen. Anritsu makes three different antennas available as options covering frequency ranges from 25 to 1700 MHz.

Options

Noise field strength measurements can also be done as the instrument has the option of being fitted with a QP (quasipeak) detector conforming to the appropriate international specifications. Quasipeak simply means that the detector has a circuit that holds the peak amplitude for a selectable amount of time. This is because noise signals are impulses in character which are difficult to see on the CRT.

Although not fitted to the test unit, the GPIB, IEEE-488 compatible bus can control all functions except power on-off, CRT intensity, frequency zero adjust, gain adjust and frequency setting. For automated test programs this facility is recommended.

Another option is the tracking generator, a swept signal source controlled by the spectrum analyser and enables responses of transmission lines, wideband amplifiers, filters and other networks to be optimised. Again, we did not have the opportunity to evaluate this option.

Performance/technical design

Routine measurements of signals were easily done although the span readout, as mentioned earlier gives the total span of frequency on the screen and not the frequency per division which is usual.

We found the panel layout excellent and a lack of rotary mechanical switches contributed to ease of operation. The two major points of criticism were the analyser's unobvious mode selection LEDs and frequency readout. Operating the data keys changes the mode, but knowing which one is active relies on observation of the appropriate key being illuminated. This indication is not bright enough unless you look directly at the key, (others who were using the instrument adjusted to this after a short time).

As far as frequency readout was concerned, we found erroneous readings above 1000 MHz. An error of 30 MHz must surely be adjustment.

The frequency conversion circuit is shown herewith.

Frequency control of the first LO is by way of a YIG oscillator. YIG stands for yttrium iron garnet. A small sphere of this material, about 0.5 mm in diameter, can be made to oscillate and is tuned by magnetic fields. YIG oscillators are useful at microwave frequencies and those who sneer at such devices in favour of PLL and synthesised oscillators, should consider that synthesis can actually result in a degraded system unless great care is taken to engineer out phase noise and other spurious products. The inherent advantage of a YIG oscillator is that it is quite spectrally clean (relatively) and it makes for linear tuning.

In this case, the first oscillator operates between 2.5214 and 4.5214 GHz; the first

IF of 2.5214 GHz contributes to very good image performance.

The second oscillator at 2.5 GHz down-converts to 21.4 MHz and a further conversion to 3.5 MHz where relative bandwidth filters, and video filter circuitry take care of the signal before it is applied to the vertical plates of the CRT.

We liked the comparative lack of controls on the front panel and the 8085 processor handles each section particularly well — very friendly.

Internally, the layout and construction is of a high order. The manual, in the usual Japanese tradition, falls somewhat short in the technical department in so far as schematics are concerned. Operating information is, however satisfactory.

Conclusion

This Anritsu MS610A analyser may not have digital display, PLL or storage facilities yet manages to produce a performance equal to other instruments in its class and at less expense.

It has the advantage of simple, clean cut design and engineering without the problems of sophisticated circuitry that must be employed for PLL, storage, etc.

As far as we could determine, specifications were met or exceeded with the exception of frequency readout above 1 GHz, and I would refer you to the test figures/specifications.

On the negative side, battery operation is not possible although the instrument is billed as portable. We understand that battery operation is on the way. The YIG oscillator is subject to magnetic influences which can distort the trace. (Try a soldering iron along side it when switched on. The trace from a signal generator looked very sick until we realised the ac magnetic field was upsetting the YIG oscillator.)

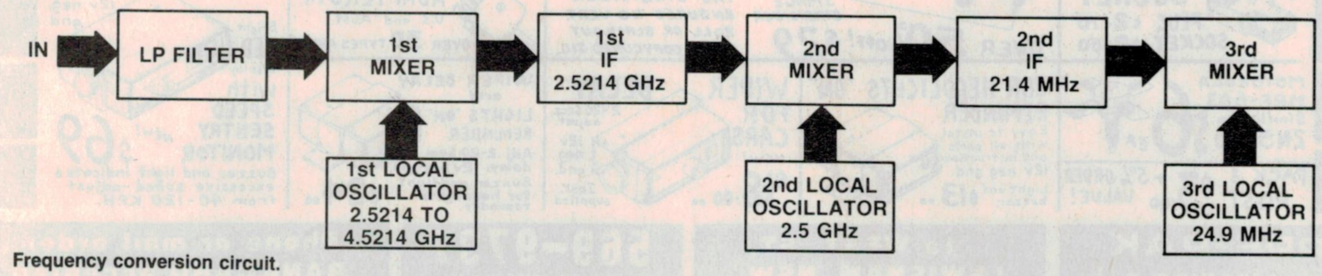
With its options of tracking generator, emi and field strength measurement potential, the MS610A is good value. No instrument is perfect but good features and practicality make it worthy of consideration if you plan to update your workshop, test lab or production line.

Peter D. Williams is director of Associated Calibration Laboratories in Melbourne. ●

TECHNICAL SPECIFICATIONS

We evaluated the essential specifications which we believe are most meaningful in terms of adequate performance.

Model		ANRITSU MS 610A Serial No M77195
Supplied		STC St Georges Rd, Thornbury, Vic.
Power		ac 240 V 48 to 63 Hz 85 VA
Dimensions & Weight		177 x 284 x 351 mm; 13.5 kg
Manufacturers Spec:		
Range		10 kHz to 2 GHz
Display/accuracy		4 digit LED 1 MHz resolution ±10 MHz
Span		zero, 0.1 MHz to 1 GHz in 1.2.5 sequence (see Table 1)
Resolution bandwidth		1 kHz to 1 MHz in 1.3 sequence (see Table 1)
Stability		better than 100 kHz/5 min after 1 hour
Residual FM		better than 5 kHz p-p at less than 0.1 s sweep
Frequency response		±1.5 dB, 100 kHz to 1.5 GHz +2 dB −3 dB, 1.5 GHz to 2 GHz
As tested in Laboratory:		
Resolution		bandwidth 30 kHz; at 3 dB down intersection of two close in frequencies, the observed bandwidth p-p was 32.4 kHz; all other bandwidths within 5%
Residual FM		sweep time: 0.1 s measured result: 2 kHz p-p spec: 5 kHz p-p
Stability	A	1 minute — 1 MHz drift from switch on 2 minute — 2.5 MHz drift from switch on
	B	5 kHz/5 min 1 hour from switch on spec: 100 kHz/5 mm from switch on
Frequency response		±1 dB to 1 GHz spec: ±1.5 dB (100 kHz to 1.5 GHz)
Residual spurious		input attenuator: 0 dB
Response		as tested: −115 dBm noise level spec: −100 dBm or less
Noise sidebands		resolution bandwidth: 1 kHz video filter: 100 Hz measured 30 kHz from signal as tested: better than 80 dB spec: better than 70 dB
AMPLITUDE		
Log scale linearity		scale selected: 10 dB/div as tested: ±0.5 dB spec: ±1.5 dB scale selected 2 dB/div as tested: ±0.3 dB spec: ±1 dB
Input VSWR		input attenuator: 20 dB as tested: 1.05:1 spec: 1.5:1 or less
Dynamic range		intermodulation (2nd/3rd harmonic distortion) input attenuator: 0 dB input level: −30 dB as tested: less than 70 dB spec: 70 dB or less



Frequency conversion circuit.

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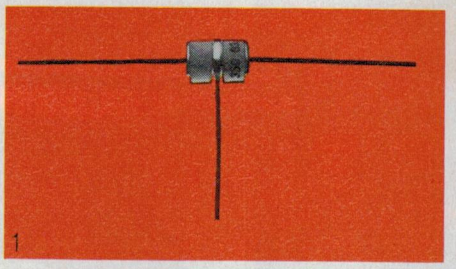
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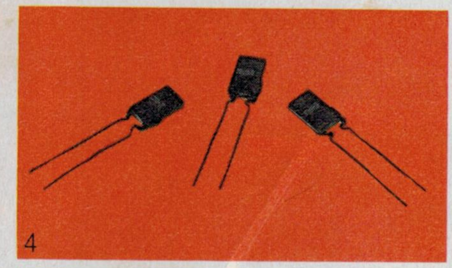
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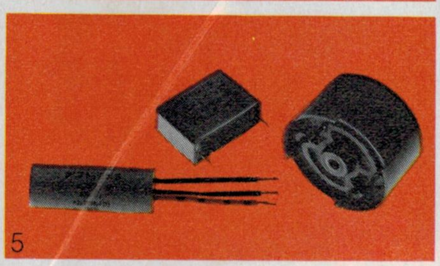
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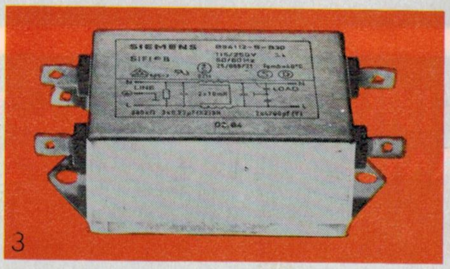

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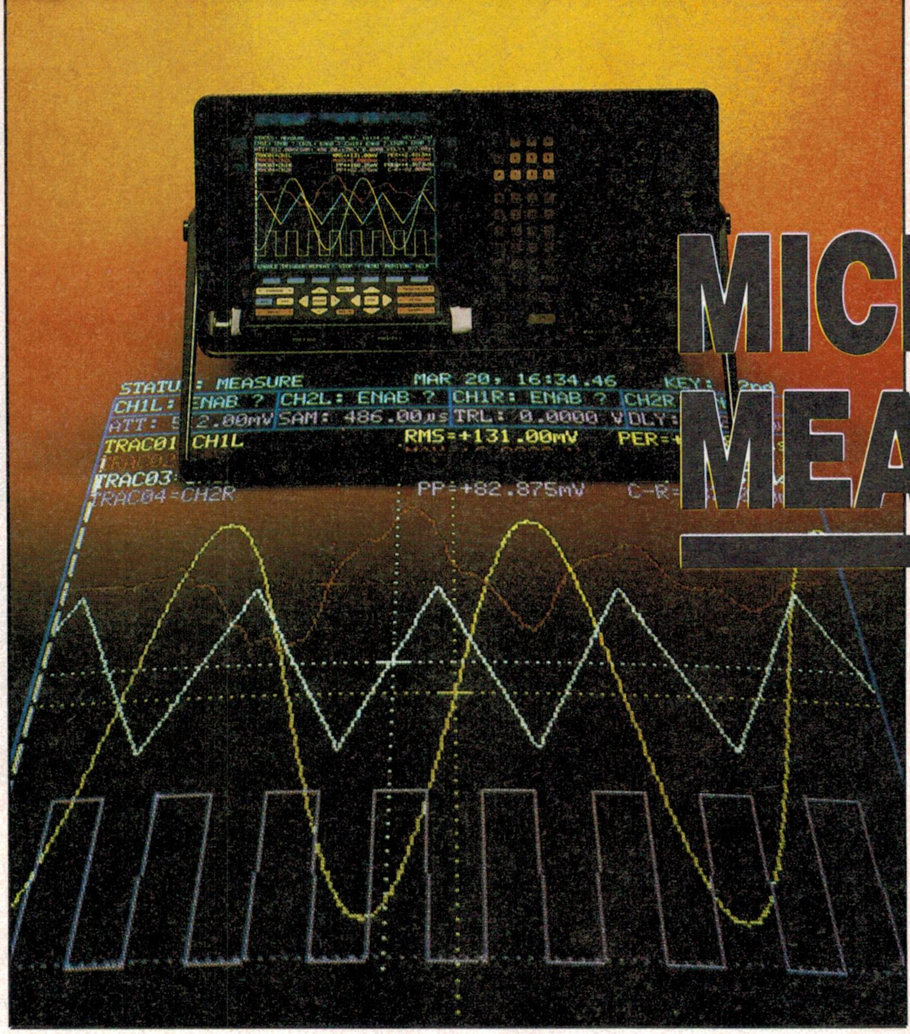

MICR
MEAS

IT'S A TRUISM that microprocessors are changing the world around us, but somehow one expects electronic measurement to be spared the ravages of computerisation. After all, a CRO is a CRO and multimeter is a multimeter and they're all quite different from spectrum analysers and frequency counters. Right? Wrong.

Philips has come up with an instrument that uses computerisation to integrate the functions of all these instruments plus power meters, Fourier analysers and timers. The link, as one might expect, is a computer, and it results in a test instrument, the PM 3360, of quite awesome power. It's called a waveform analyser. At $30,000 odd, it is not for the faint hearted, but it comes with a battery of features that are sure to create interest in labs and on assembly lines all over the country.

The quickest way to come to terms with the PM 3360 is to consider it as two distinct instruments. On the one hand a digital CRO, on the other a computer. The CRO has four possible inputs, and 10 possible traces, defined in seven different colours. The relationship between the channels and the traces is entirely up to the operator. It is possible, for instance, to assign all 10 traces to a single input, or two to each input, or whatever other combination you want.

The traces are important because all the measurements in the system are done on the traces, not the inputs. Thirty-one different measurements can be defined on any one trace, but it's only possible to make two measurements at any one time. If you want more information you have to assign more traces to the input.

This sounds complicated, and indeed, one could make the same measurements a lot quicker with a CRO. That's where the computer comes in. If you select the MONITOR option on the console you wind up with an ordinary computer screen in front of you, fully programmable in a standard, dull as ditchwater, BASIC. If the mood takes you, you can make it jump through all the same hoops your home micro does. However, there are a few addenda. These are the commands for controlling the CRO, and give the device unique power.

From the program it is possible to control all the parameters one can control from the front panel. For instance: `TRL = 0` sets the default channel trigger level to 0 V, `CPL$=''AC''` sets it to ac coupled mode. You have complete control of the trace. `COL$` sets its colour, `TRS$` selects the trace for working on (default), and so on. One of the most important words is `VAL`, which asks for some measurement to be performed on the default trace. For instance `PRINT VAL ''FREQ''` will return the frequency of the trace.

This type of programming has obvious

OS JOIN THE SUREMENT REVOLUTION

— Philips PM 3360 waveform analyser

Increasing computer power is changing the nature of test and measuring instruments. The PM 3360 is just such a changed beast. Neither a CRO nor a spectrum analyser nor a frequency counter, it winds up being greater than the sum of its parts.

Jon Fairall

advantages in routine testing type applications or troubleshooting. It is possible, for instance, to make the computer display a message like ''PLACE PROBE ON POINT A'', wait for an input, measure it, then display further messages according to whether the measured inputs are within certain limits.

One thing that impressed me was the softkeys. The softkeys are a line of buttons across the top of the keyboard. Each has associated with it an area at the bottom of the display that can be labelled with the SKY$ command. Thus SKY$(1)=''ready'' puts the word READY into the label space, and the command KEY% is used to test whether the appropriate softkey has been pressed.

In many instances it might not be an advantage to do things in real time. The PM 3360 has the ability to store a waveform in memory for later retrieval and manipulation. You can also create new traces by performing mathematical calculations on existing ones. For instance, if you have set TRACE1 to measuring volts, and TRACE2 to measuring amps, you can see a power curve simply by defining a third trace to be TRACE1 x TRACE2.

Even more complex operations are possible because of the disk drives. These can be used to load and save specialised programs, or Philips' own AMS 11 (advanced mathematical processing) package. This gives access to things like real time spectrum analysis using a Fast Fourier Transform on the input signals, and auto correlation, a statistical function that allows one to extract the significant elements of a noisy signal.

This really only scratches the surface of the systems capabilities. The triggering capabilities alone would fill a thousand word article, and so would a description of the peripherals. It's possible to buy different input modules that go up to 50 MHz, all with two fully independent channels. It's fully programmable from either an external keyboard or IEEE-488 bus. Output peripherals include RGB monitors and colour printers.

The biggest problem with the PM 3360 is a psychological one. Like anyone with an electronics background, I expect CRO to look and act like a CRO and when it doesn't I get quite judgmental. According to Graham Blanchett, who leads Philips' marketing effort on the PM 3360, it's a common enough failing. "The biggest problem we have is convincing people that it's not a CRO and should not be judged as one. You might as well call it a signal analyser."

According to Philips, it's wrong to see it as a replacement for a digital CRO. It doesn't work at that level. Typical applications include vibration analysis, FET testing and so on. There must also be strong interest from people with any kind of reasonably low frequency testing requirements.

All in all, I was impressed with the PM 3360. Philips deserves to have a winner with this one. There are only two beefs worth mentioning. I would have liked to have seen Philips put a bit more time and energy into creating a good manual for this machine. Some parts of it are written with such a thick Dutch accent it's quite incomprehensible, and trial and error becomes indispensible. At $30,000 we are entitled to better.

The other thing that made me wince was the slow response from the keyboard. Even with the terrible design Philips has come up with for the front panel I could beat the computer easily, leading to all kinds of errors and the constant necessity for retyping. I don't understand why this should be so; the thing has a 16-bit data bus, and five processors inside, so you'd think it would really motor along. Such is not the case.

However, these are idiosyncracies. I got used to them in the first half hour. What begins to impress then is the tremendous versatility and power of the instrument. The next generation should take ergonomics a little more seriously.

●

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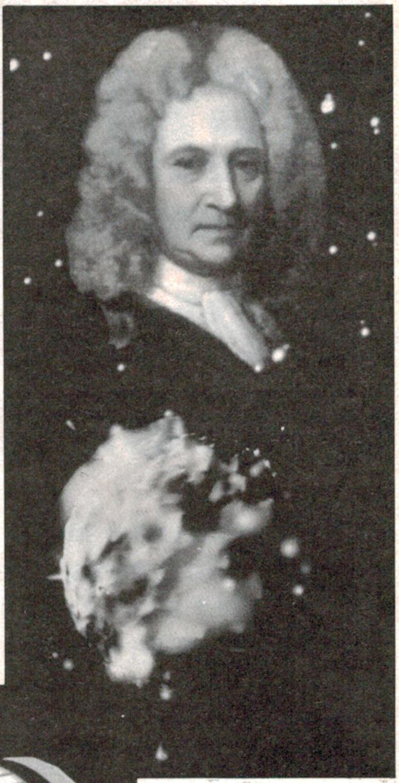
DISCOVERING A COMET CALLED Halley



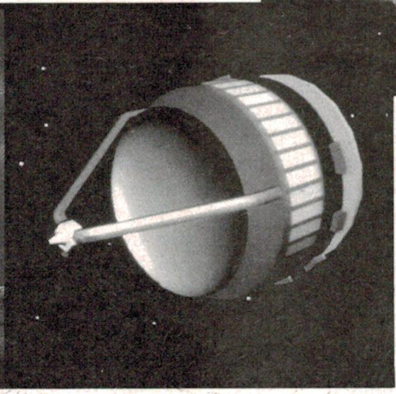
Regular as clockwork, once every 76 years, a spectacular Comet hurtles into the solar system to sweep through the night skies of planet Earth.
For a few tantalising weeks the Comet is plainly visible to the naked eye – trailing a fantastic tail hundreds of thousands of kilometres long.
A Comet Called Halley tells where to look and how to photograph the Comet, what comets are and where they come from. Throughout history the Comet has terrified and fascinated people. Thanks to the work of Edmond Halley those fears were finally allayed, and our excitement now stems from the possibilities of learning more about comets from ground-based telescopes and the space probes flying to intercept Halley's Comet.

It's in our skies once more...
Now, everything that scientists know so far

The Comet was seen by Edmond Halley at Islington in 1682. He predicted its return in 1759. It was sighted on December 15, 1758.

Far from the sun, a comet resembles a snowball of ice and dust a few kilometres across.

The appearance of Halley's Comet relative to the horizon for 30°s.



Giotto is the European Space Agency's probe to Halley's Comet, named after the Italian artist who depicted the Comet in his painting of the "Adoration of the Magi".

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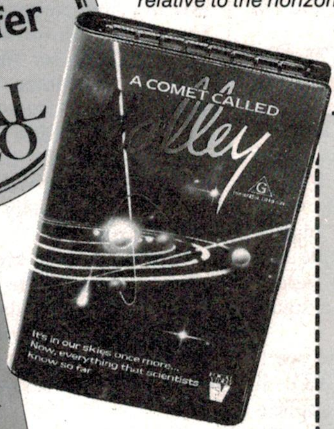

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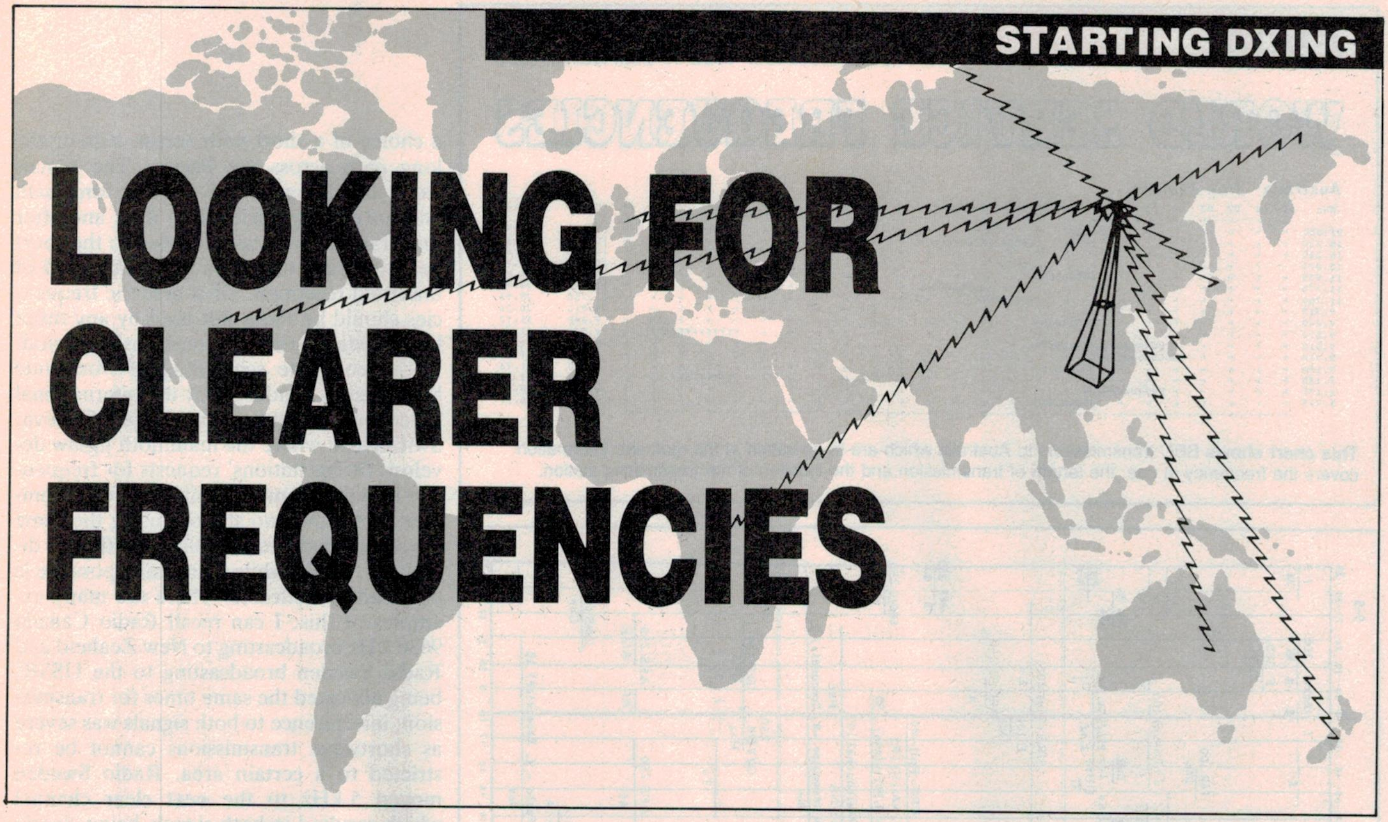


LOOKING FOR CLEARER FREQUENCIES

There are many reasons for the mysterious appearance or disappearance of signals on various frequencies. In fact, integrating the whole caboodle of countries and schedules is a bit of a headache for a whole lot of people.

Arthur Cushen

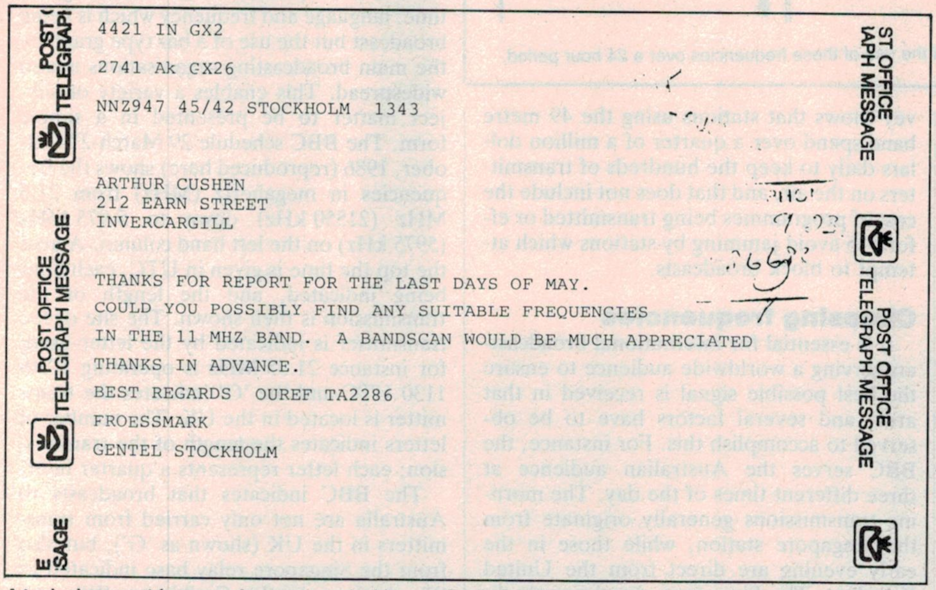
NEW LISTENERS OFTEN remark that stations change frequency without reason, often reappearing on another channel which gives better reception.

This move towards clearer signals via a new frequency does not just happen. Many hours of listening are involved in finding a clearer frequency so that the station can make the change assured of better reception. This writer has been monitoring for the BBC for 43 years and reports to London to indicate any interference. A monitor is requested to take a painstaking look at the occupancy of the band to find a clearer frequency region. This involves running receivers on the new frequency over a given period to ensure that no one else is using the channel before a decision is made to telex the BBC with the suggested channel.

The sharing of frequencies in an orderly manner is the prime intention of the International Frequency Board (in Geneva). International broadcasters submit their operating plans to the IFB several weeks in advance and it attempts to co-ordinate these requests. No country has a right to any frequency though traditionally countries try to stay on the same spot on the dial so that listeners have no problems locating their favourite station. For instance the BBC's oldest call sign GSA was assigned to 6050 kHz, GSB 9510 kHz and GSC 9580 kHz and these frequencies are still looked on as being for BBC use, though they were assigned 50 years ago.

The seasonal changes which occur on the first Sunday in March, May, September and November result in some frequency and schedule readjustments as stations move from winter to summer and so try to serve their listening area on the best available frequency.

There are changes made at other times of the year. These days also, the change from standard to daylight time is often used as a period of adjustment. Changes occur for various reasons. Sunspots appear every 11 ▶



POST OFFICE TELEGRAPH MESSAGE

4421 IN GX2

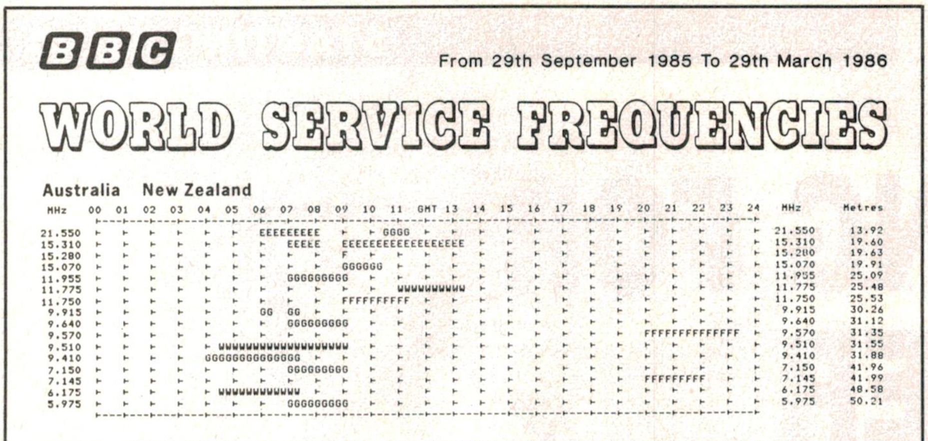
2741 Ak GX26

NNZ947 45/42 STOCKHOLM 1343

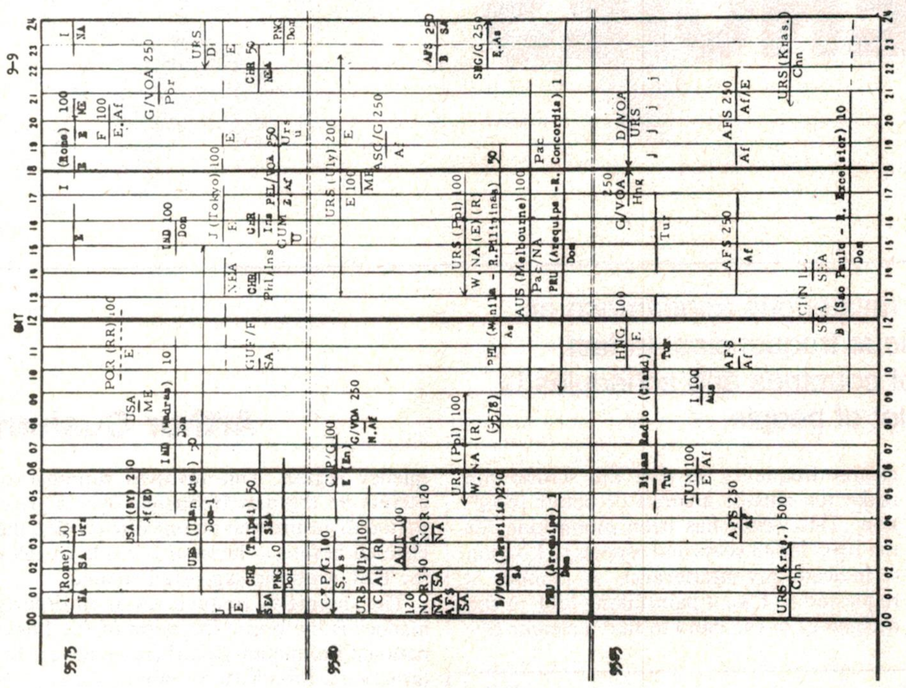
ARTHUR CUSHEN
212 EARN STREET
INVERCARGILL

THANKS FOR REPORT FOR THE LAST DAYS OF MAY.
COULD YOU POSSIBLY FIND ANY SUITABLE FREQUENCIES
IN THE 11 MHZ BAND. A BANDSCAN WOULD BE MUCH APPRECIATED
THANKS IN ADVANCE.
BEST REGARDS OUREF TA2286
FROESSMARK
GENTEL STOCKHOLM

A typical request for a new frequency — in this case Radio Sweden asks for a check in the 11 MHz band and a survey of frequency occupancy.



This chart shows BBC transmissions to Australia which are in operation at the moment. Information covers the frequency in use, the length of transmission and the location of the transmitting station.



This survey of frequencies 9575-9585 kHz shows the use of these frequencies over a 24 hour period.

years. At the moment the sunspot count is only around six which means that we are at the low of the 11 year cycle. Congestion on the 49 metre band is typical during the low sunspot count as only the lower frequencies are available to SW stations. In a few months the spots will increase which will mean that the higher frequencies such as the 13 and 11 metre bands will again be open for transmissions.

Some comment on the 49 metre band shows how bands are divided up. On this band, between 5950 and 6200 kHz, 49 channels are available. By international agreement, stations should not be closer than 5 kHz apart; BBC engineers prefer 10 kHz separation because of interference on adjacent frequencies. This would leave only 25 channels available in this band, which is used by many stations in Europe to provide reception to the immediate vicinity. A survey shows that stations using the 49 metre band spend over a quarter of a million dollars daily to keep the hundreds of transmitters on the air, and that does not include the cost of programmes being transmitted or efforts to avoid jamming by stations which attempt to block broadcasts.

Choosing frequencies

It is essential for international broadcasters serving a worldwide audience to ensure the best possible signal is received in that area, and several factors have to be observed to accomplish this. For instance, the BBC serves the Australian audience at three different times of the day. The morning transmissions generally originate from the Singapore station, while those in the early evening are direct from the United Kingdom. The Singapore signal travels directly to Australia, but from the UK there is a choice of a short path across Asia or the long path across the Pacific. The signals from the UK generally use the long path and lower frequencies until dark and after that transmissions are switched to the short path. At dusk there is a problem period of unsettled reception. Of course the frequencies should be those not used by any other broadcaster during the transmission period.

The complete scheduling of worldwide broadcasts is conducted by the International Telecommunication Union in Geneva, Switzerland where the mammoth jigsaw develops fitting stations' requests for frequencies into the channels available. Not uncommon, is to find two stations using the same frequency, but broadcasting in different directions, which while technically possible is not really practicable. There are many examples of this; I can recall Radio Canada 9630 kHz broadcasting to New Zealand and Radio Sweden broadcasting to the USSR, being allocated the same times for transmission; interference to both signals was severe as shortwave transmissions cannot be restricted to a certain area. Radio Sweden moved 5 kHz to the next clear channel which resulted in both signals being clearly received.

There are examples of very good cooperation between broadcasters and recently I suggested Radio Nederland use 9650 kHz for its transmission to Australia 1030-1125 UTC from Bonaire. This frequency is now used by Spain up to 0900 UTC, Germany 0930-1025 UTC, Holland 1030-1125 UTC and Canada from 1200 UTC.

Understanding schedules

Broadcasters continue to present their schedules in printed form indicating the time, language and frequency which is being broadcast but the use of a bar type graph by the main broadcasting organisations is also widespread. This enables a variety of subject matter to be presented in a simple form. The BBC schedule 29 March-27 October, 1986 (reproduced here) shows the frequencies in megahertz (MHz) from 21.5 MHz (21550 kHz) down to 5.975 MHz (5975 kHz) on the left hand column. Across the top the time is given in UTC, each hour being indicated, and the length of the transmission is then shown. The site of the transmitter is indicated by the letter used: for instance 21.55 MHz is operating 1030-1130 UTC and the 'G' indicates the transmitter is located in the UK. The number of letters indicates the length of the transmission; each letter represents a quarter hour.

The BBC indicates that broadcasts to Australia are not only carried from transmitters in the UK (shown as 'G'), but also from the Singapore relay base indicated as 'F', Antigua in the Caribbean, 'W', and from Masirah in the Persian Gulf shown as

'E'. The BBC also indicates transmissions from the Atlantic relay on Ascension as 'A', Eastern Mediterranean relay, Cyprus as 'C', while 'K' indicates the relay from the Voice of America at Greenville and 'S' a relay from Radio Canada International at Sackville.

This style of frequency information is used by the Voice of America which indicates the site of the transmitter and the power into the area being served on its transmission line. Most other broadcasters present their information in a standard form which indicates information in order of time, followed by the language, frequency, target area and the bearing of the aerial system.

Band survey

There is a tremendous amount of information available from radio stations including schedules of programme information. In Geneva, the International Telecommunication Union produces a book showing the frequencies assigned to shortwave stations throughout the world. This information can only be taken as tentative, as often the frequencies offered by the ITU are not accepted by the broadcaster, while many stations in Eastern Europe do not adhere to frequency allocations, and are likely to be received on any frequency without prior notice, (thus causing considerable havoc to the orderly allocation of channels).

Most international broadcasters have agreed that there should be a limited number of frequencies used by one station in a shortwave band and, as well, that the total number of transmitters carrying the same programme should be restricted. Looking at the schedule of Radio Moscow World Service in English at 0700 UTC, it shows there are 41 frequencies in use to carry this single programme which means complete domination on most of the shortwave bands by this single programme. It is obvious that good frequency choice could reduce the number of transmitters to 10 and still provide an effective service.

Each month this writer has the task of identifying the source of transmissions and the length and time of broadcasts, and to rate their signal strengths. This work is aided by scheduling information from over 70 broadcasters, but practical listening is paramount as many stations are found not to be operating as they advise. This practical exercise, for instance from 0200-0430 UTC, enables identification of over 120 signals in the 25 metre band from 11700-11975 kHz. The information is plotted on a graph, and the country from which the broadcast originates is identified by a symbol. This symbol should not be confused with the call sign which is assigned to all countries for use by radio amateurs, (for instance Australia is identified as AUS, whereas the amateur radio prefix is VK; New Zealand is identified as NZL although the amateur prefix is ZL). See the accompanying complete list of the abbreviations for the various countries.

When surveying a shortwave band, a log should be kept showing each frequency listened to and stations identified. New stations to a frequency are soon recognised: identification of languages is important and the sound of the various transmissions enables one to identify a signal even before the announcement is made. Even knowing that stations announce on the hour, it can take several days to fully identify the mystery signals one receives. The Moscow Home Service programmes, for example, are found on many unlisted frequencies. To overcome this problem one receiver can be left running on such a transmission so that when a similar programme is heard on another frequency, identification can be made.

The increasing number of Arabic speaking stations coming on to the shortwave bands also causes problems. The main broadcasts in the Russian language from stations in Western Europe between 0315-0345 UTC is the reason for increased jamming of channels during that time period. There are many frequencies which listeners will find are jammed continually. Generally the broadcasts of Radio Liberty or Radio Free Europe are completely buried by this deliberate interference.

After a survey is completed one can see at a glance those frequencies that are not being used. This is essential information for any shortwave broadcaster looking for new channels. ●

A list of abbreviations is used internationally to identify location of the various countries using the shortwave bands.

AFG	Afghanistan	G	Great Britain and N. Ireland	NZL	New Zealand
AFS	South Africa	GAB	Gabon	OAS	Org. of Am. States
AGL	Angola	GHA	Ghana	OCE	Tahiti
ALB	Albania	GIL	Gilbert and Ellice Islands	OMA	Oman
ALG	Algeria	GMB	Gambia	PAK	Pakistan
AND	Andorra	GRC	Greece	PHL	Philippines
ARG	Argentina	GRL	Greenland	PNG	Papua New Guinea
ARS	Saudi Arabia	GTM	Guatemala	PNR	Panama
ASC	Ascension Islands	GUR	Guyana	POL	Poland
ATN	Netherlands Antilles	GUF	French Guiana	POR	Portugal
AUS	Australia	GUM	Guam	PRG	Paraguay
AUT	Austria	GUI	Guinea	PRU	Peru
B	Brazil	HNB	Belize	QAT	Qatar
BBC	British Broadcasting Corp.	HND	Honduras	RFU	Reunion
BDI	Burundi	HNG	Hungary	RFE	Radio Free Europe
BEL	Belgium	HOL	Holland, Radio Netherlands	RHS	Rhodesia
BEN	Benin	HTI	Haiti	RL	Radio Liberty
BGD	Bangladesh	HVO	Upper Volta	ROU	Romania
BHR	Bahrain	HWA	Hawaii	RRW	Rwanda
BHU	Bhutan	I	Italy	RTU	Ryukyu Islands
BLR	Bylorussia	IND	India	S	Sweden
BOL	Bolivia	INS	Indonesia	SDN	Sudan
BOT	Botswana	IOB	British West Indies	SEN	Senegal
BRN	Burma	IRN	Iran	SEY	Seychelles
BFU	Brunei	IRQ	Iraq	SHN	Saint Helena
BUL	Bulgaria	ISL	Iceland	SLM	Solomon Island
CAF	Central African Republic	ISR	Israel	SLV	El Salvador
CAN	Canada	J	Japan	SNG	Singapore
CBG	Cambodia (Khmer Republic)	JOR	Jordan	SOM	Somalia
CHL	Chile	KEN	Kenya	SRL	Sierra Leone
CHN	People's Republic of China	KOR	Korea (Republic of)	SUI	Switzerland
CHR	Republic of China (Taiwan)	KRE	Korea(People's Dem. Rep. of)	SUR	Surinam
CKN	Cook Islands	KWT	Kuwait	SWZ	Swaziland
CLM	Colombia	LAO	Laos	SYR	Syria
CLN	Sri Lanka	LBN	Lebanon	TCD	Chad
CME	Cameroon	LBR	Liberia	TCH	Czechoslovakia
CNR	Canary Islands	LBY	Libya	TCK	Tanzania
COG	Congo	LUX	Luxembourg	TGO	Togo
COM	Comoro Islands	MAU	Mauritius	THA	Thailand
CPV	Cape Verde Islands	MCO	Monaco	TUN	Tunisia
CTI	Ivory Coast	MDG	Malagasy	TUR	Turkey
CTR	Costa Rica	MEX	Mexico	TWR	Transworld Radio
CUB	Cuba	MLA	Malaysia	UAE	United Arab Emirates
CVA	Vatican State	MLD	Maldive Islands	UGA	Uganda
CYP	Cyprus	MLI	Mali	UKR	Ukraine
D	Federal Republic of Germany	MLT	Malta	UN	United Nations
DAH	Benin	MNG	Mongolia	URG	Uruguay
DDR	German Democratic Republic	MOZ	Mozanbique	URS	Union of Soviet Socialists Republics
DNK	Denmark	MRC	Morocco	USA	United States of America
DOM	Dominican Republic	MRT	Martinique	VEN	Venezuela
DW	Voice of Germany	MTN	Mauritania	VOA	Voice of America
E	Spain	MWI	Malawi	VTN	Vietnam
EGY	Egypt	NCG	Nicaragua	YEM	Yemen
EQA	Ecuador	NCL	New Caledonia	YMS	Southern Yemen
EQG	Equatorial Guinea	NGR	Niger	YUG	Yugoslavia
ETH	Ethiopa	NHB	New Hebrides	ZAI	Zaire
F	France	NIG	Nigeria	ZAN	Zanzibar
FJI	Fiji	NOR	Norway	ZMB	Zambia
FNL	Finland	NPL	Nepal		

DBASIC

by Paul Jones

Types of BASIC proliferate like rabbits. There is CBASIC, ZBASIC, MBASIC, Extended BASIC, Tiny BASIC etc. Well, here is Dregs BASIC (DBASIC), for the person tired of 'USER FRIENDLY'.

It was written by a depressed systems analyst who had just left his job after seeing another 'USER ERROR' notice on his VDU. It is designed to enable anyone, familiar with basic BASIC, to write error free programs.

Program structure in DBASIC does not exist, so you can build your program any way you like. DBASIC starts at a randomly selected line number and continues haphazardly through the uncompiled list of statements until it finds an OBJECT statement. This contains the REASON and RESULT data which is then examined by a Decentralised Processing Element, called COMMITTEE. If the REASON is reasonable and allocated resources are high enough then the RESULT data is printed on the screen.

A summary of commands:

+−*/

These are used in character strings to represent a cross, a dash, a star and a slash.

REM

Provided to take up memory space and make the programmer look like an idiot by writing stupid comments.

PAUSE

A long way of representing a ','.

STOP

The only statement which can be relied upon to work most of the time.

BRIBE

Allocation of resources to COMMITTEE.

IF...THEN...SO WHAT

An extension of the classic IF...THEN, except that ALL results are ignored and the program continues on the next line anyway.

HO-HUM

Printed on screen during FOR...NEXT loops.

ON ERROR, IGNORE

Guarantees a result even if the result is wrong.

HOW ABOUT

Precedes complex functions to show that you are not really expecting a quick result.

HAVE A GO AT

Precedes complex functions to show that you think the function is beyond the abilities of the computer.

NO WAY

Computer reply to a HAVE A GO AT statement.

INTEREST LOST

Automatic power down and program halt.

INTEREST REGAINED

Automatic power on.

POKE

Writes important data into an unknown memory location.

DELAY

Used to ensure you can get overtime while waiting for the program to produce a result.

LIST

A list of people who could answer your problem without the need of a computer.

This DBASIC is supplied with a complete, two page leaflet, detailing where to send more money for more information. A listing is available, in Chinese, and the program is supplied on 32 old wax cylinders and is not compatible with current computers. Should become an industry standard by 1892. ●

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